





University of North Carolina Sea Grant Program NEWSLETTER

May, 1974

1235 Burlington Laboratories NCSU, Raleigh, N.C. 27607 Tel: (91<u>9)</u> 737-2454

Sea Grant serves you:

New morsels for your seafood platter

Tuna seems to show up everywhere. The hungriest, dirtiest construction worker gobbles down a couple of tuna sandwiches for lunch. And tuna salad is an old standby at ladies' dainty teas.

But watch out, tuna. It's possible that before long, wives will pack amberjack sandwiches for hubby's lunch and ladies will top off the lettuce with something called white grunt salad. Restaurants may feature dishes like triggerfish parmesan and barracuda casserole.

Amberjack, white grunt and barracuda—all caught by fishermen off North Carolina's coast for years. "Trash fish" they called them—then hurled a curse and dumped them back.

But with the world's stomach growling for protein and with an eye toward spurring the economy of deprived coastal areas, folks began wondering about turning "trash" fish into useful foods.

They also put their minds to improving the harvesting, handling and processing of seafoods people have eaten for centuries. But making more of a catch meant setting up lines of communication between the men who catch and process seafoods and engineers and scientists who test and design new methods.

That's where Sea Grant stepped in. Sea Grant is a University of North Carolina program that gets money from the U. S. Department of Com-



merce's National Oceanic and Atmospheric Administration (NOAA) and the N. C. Department of Administration. Part of Sea Grant funds support research aimed at developing coastal and marine resources in an environmentally sound fashion.

But Sea Grant is equally anxious to get research results to people who can profit from them. That includes everyone from the guy setting the nets to the businessman eating crabcake. For that reason a portion of Sea Grant funds are channeled into something called "advisory services." The men and women in advisory services are messengers between the lab and the coastal community. Their purpose is to translate research findings into information that can be put to use. In turn they take questions posed by coastal residents back to the lab for answers.

In North Carolina, Sea Grant advisory services does three jobs. Engineering advisory services deals with gear, helping fishermen and shrimpers with harvesting and handling the catch on board. Seafood science and technology follows the catch from dock to consumers. And a continuing education program keeps commercial fishermen up to date on the latest equipment, how to use it and running a business.

In the future Sea Grant advisory services aims

(See "Better Use," page 3)

seascope



Dr. B. J. Copeland

Dr. Copeland, a zoologist, assumed the directorship of the UNC Sea Grant Program in 1973. He is a professor of zoology, botany and marine sciences at North Carolina State University, Copeland came to NCSU in 1970 from the University of Texas Marine Science Institute at Port Araysos.

This first issue of our newsletter is one more way that we are trying to make Sea Grant activities come alive to the people of North Carolina.

Through our newsletter, we hope to air some of our achievements, make our facts, findings and information readily available and alert interested persons to upcoming events. We also hope to set up a flow of communication between the people in Sea Grant—its administrators, researchers and the University—and those who can profit from the program's work. To keep information flowing in two ways, we need to hear from our readers.

In this issue, we are emphasizing Sea Grant's program of advisory services. Future newsletters will focus on other areas covered by Sea Grant. What is advisory services?

In short, it's the communications arm of the entire Sea Grant program. The men and women in advisory services relay up-to-date research results and ideas to those people who make decisions about the management, development and protection of North Carolina's coastal and marine resources.

Advisory services also sees that Sea Grant programs are co-ordinated between the institutions of the University of North Carolina and local, state and federal agencies dealing with coastal and marine resources.

To make sure that Sea Grant is in tune with the needs of coastal North Carolinians, Sea Grant's advisory services personnel devote a large part of their time to listening to problems confronting coastal people. When information needed for a solution is not at hand, advisory services brings coastal questions to the Sea Grant researchers and administrators who may be able to help.

The work of Sea Grant's "advisors" is aimed at short-term as well as long-term problems.

Through the efforts of Dr. Leigh H. Hammond, who for the past year has acted as co-ordinator of UNC Sea Grant advisory services, the individual projects that make up advisory services are finely attuned to the purposes of the UNC Sea Grant Program. Hammond's guiding hand keeps the entire advisory services program aimed toward the program's goals of increasing and improving the usage of coastal and marine resources in a wise manner. Hammond, an extension professor of economics, is also assistant vice chancellor of University extension at North Carolina State University.

In the three years since UNC Sea Grant was first funded, the program has focused on the economically important commercial fisheries industry. In the future, we plan to broaden this focus to other equally important coastal zone industries and needs.

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ALERT!

PEST CONTROL-May 8-9.

Training course: Mosquito and biting fly control in coastal areas. May 8-9, Room 104, Commercial and Sports Fisheries Building, Morehead City. Designed to further inform pest control operators and other interested persons on coastal pest problems and their control. Taught by NCSU entomologists and the Solid Waste and Vector Control Branch of the N. C. Division of Health Services. Sponsored by UNC Sea Grant and NCSU Agricultural Extension. Write to Dr. R. C. Axtell, Department of Entomology, NCSU, Raleigh, N. C. 27607 to register in

EEL FISHING-May 7 and May 9

Workshops—Eel fishing and handling. May 7, Savannah, Ga., May 9, Brunswick, Ga. Led by Norm Angel and Walt Jones, Industrial Extension Service, NCSU School of Engineering in cooperation with Onslow County Community College. Sponsored by the Coastal Plains Marine Center and University of Georgia Sea Grant.

COASTAL MANAGEMENT—May 16-17

Conference: A forum of views on land management in the coastal area, presented by state and local governments, developers, planners, financial interests and the public. May 16-17, Duke University Marine Laboratory, Beaufort. Sponsored by UNC Sea Grant, Center for Marine and Coastal Studies and the Coastal Plains Center for Marine Development Services.

DREDGE ISLAND MANAGE-MENT—May 30-31

Conference: Managing dredge islands in North Carolina's estuaries. May 30-31, John Yancy Hotel, Atlantic Beach. Review possibilities and problems of managing dredge islands as bird nesting sites. Aimed at informing state and federal agencies and persons having jurisdiction over and interests in managing dredge islands. Led by Dr. James Parnell, UNC at Wilmington, and Robert F. Soots, Campbell College. Sponsored by UNC Sea Grant.



Twelve Carteret County women meet at the seafood lab each month to experiment with new seafood dishes.

A lab dealing in seafood from dock to dinner plate

You own a seafood processing plant. And you want to turn out the tastiest crabcake on the market. Or maybe you're tired of the way your wife fries flounder and you want to get her some new recipes. Where do you go for help?

Tucked away on the second floor of the N. C. Division of Commercial and Sports Fisheries building in Morehead City is a special seafood laboratory geared for questions from everyone between the dock and the dinner plate. Information on the science and technology of seafood is the lab's business

Supported largely by Sea Grant advisory services, the lab's staff answers all sizes of questions. They help school girls with term projects. Restaurants come to them with "cooking" problems. And they lend a hand when processors need help with sanitation, a new deboning machine or making better products. Staff members take pride that theirs is the only seafood "technology" laboratory serving North Carolina's unique fisheries processing problems.

For those who are tired of the same old seafood, the lab is trying to add a little zest to life. Once each month, a dozen Carteret County women descend upon the lab to concoct new seafood delights—and delights that don't sound a bit like seafood. Like mad scientists, they've made hamburgers with menhaden and sausage with grey trout. And they've whipped up such dishes as dolphin casserole and stewed bonito.

The lab offers a gold mine of information, just

waiting for folks to come by and use it.

Creating a new industry and improving the old

The idea of eel for dinner is not likely to set American tastebuds to watering. But try it out on the Japanese. To them, it's a delicacy.

Eels grow in abundance off North Carolina's coast. But how do you get them halfway around

the world to the people who want them?

Developing an eel industry in North Carolina poses the kind of challenge Sea Grant's engineering advisory services staff likes to grapple with. Starting from scratch, the engineering advisory specialists are designing pots, traps and holding tanks and figuring how to best ship eels to distant markets.

But eels are only one part of the work of Sea Grant's "advisory engineers," headquartered in downtown New Bern. They tackle most anything having to do with harvesting gear and handling the catch from deck to dock.

With Sea Grant help, North Carolina shrimpers got their first time at bat with a new trawling method using two small nets on each side of the boat, instead of the traditional large single net. Using the twin trawl method, they caught more shrimp and less "trash" fish, and found their fuel would take them farther.

But what happens to the catch on board? Engineering advisory services is there suggesting ways to keep the catch fresh, even on old vessels. Insulating old boats took some thinking. But the advisory engineers came up with polyurathene foam, sprayed into fish holds and ice bunkers, topped off with layers of sheet metal and concrete as a way to protect ice from heat. And with the price of ice soaring and the distances they travel often long that's exactly what every fisherman wants to do.

Better use of sea products

(Continued from page 1)

to branch beyond fishing. Who knows, besides new seafood dishes, coastal visitors may find amusement parks featuring new brands of fun as Sea Grant lends a hand to the recreation industry. There may be fewer of those pesky mosquitoes as Sea Grant assists in insect control. And coastal property may just look better as Sea Grant advises local governments in managing lands.

Pooling resources today for tomorrow's profit

Ever since man began trying to eke out a living from fishing in North Carolina's coastal waterways, he's been at the mercy of two masters. Nature, it seemed, sealed the fate of the size of his catch. And back on shore, the marketplace determined how much he got for it.

Oddly, the more generous Nature was with supplies, the more stingy the marketplace was

with dollars.

Fishermen in other places overcame at least one of their masters—that monster of the marketplace. Sea Grant, through a program called "continuing education," is helping North Carolina's fisherman do the same. The Sound and Sea Fisherman's Association Inc., which grew out of continuing education, now offers about 250 member fishermen a chance to call some of the shots at selling time.

With resources pooled in a cooperative, members can buy ice, fuel, nets and rigging in bulk at cheaper prices. Probably most important is the Association's build-up of freezer space, where sea products can be held until supplies shrink and market value goes up. Co-op headquarters are in Wanchese and plans are for storage and modern handling facilities to dot the coast from Ocracoke

to Virginia.

Forming a co-op has meant refreshing members in accounting and good business management. In addition continuing education continually updates fishermen on new equipment, like the hydraulic lift, and how to use it. Through demonstrations, new options in the fisheries business, such as clam culture, are presented to coastal residents.

A library on wheels, stocked with information on everything from weather to building boats, travels throughout the Albemarle region, keeping the lines of communication open between the lab

and the folks who need help.

The folks to see

So who can you turn to with questions about your processing plant, making eel pots or joining a fisherman's cooperative?

At the Seafood Lab in Morehead City—Ted Miller's been in the Morehead City area for more than 20 years now, working with the fishing industry and now at the lab. He and staff, David Hill and Linda Burgess, are eager to lend a hand in answering questions about most any aspect of seafood science and technology. They work closely with extension food specialist Frank Thomas at North Carolina State University. Thomas, a familiar face in the coastal area for the last 16 years as a peddler of education, is another link between you and the research laboratory.

Engineering advisory services in New Bern.—Norm Angel and co-workers Art Chleborwicz, Walter Jones and Gene Crow are the men who are willing to get out there with you and help with your harvesting gear problems and taking care of the catch on board. They're in an office over the Branch Bank and Trust building in New Bern.

Fisherman's co-op and continuing education—To find out more about the fisherman's co-op, new equipment or if you're having trouble keeping the books, contact Jim McGee at the Division of Continuing Education at East Carolina University. Sumner Midgett in Camden and Hughes Tillet in Wanchese also can help you get the information you need.

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University of North Carolina Sea Grant Program

NEWSLETTER

JUNE. 1974

1235 Burlington Laboratories NCSU, Raleigh, N. C. 27607 Phone: (919) 737-2454



Young brown pelicans find life free from predators on North Carolina's dredge spoil islands.

Designing a home for waterbirds

Jutting skyward from North Carolina's vast system of sounds and estuaries are hundreds of islands—some large, some small, some dotted with tall pines, others like small deserts.

The man-made islands, built over the years with sand and mud dredged from the state's 1,500 miles of channels, are, for most of the year, deserted.

But one day in May, the silence that blankets the islands is broken, first by a single squawk, then by the deafening screech of hundreds of waterbirds.

A few weeks later, the dredge islands are teeming with life. Terns, gulls, willets and hordes of other waterbirds nest and raise their young there, safe from predators and rude intrusions.

Not much was known about the waterbirds and their nesting patterns until Dr. James Parnell, biologist at UNC-Wilmington, and Robert Soots of Campbell College began going to the dredge islands to study plant succession three springs ago. Now the birds receive the focus of their Sea Grantsupported research.

Important to the birds, the researchers found, is the level of vegetation covering the dredge spoil. Royal terns, for instance, nest on almost bare sand. Common terms prefer sparse grass, gulls nest in thick grass, and herons and egrets raise their young in shrubs and woody thickets.

According to Parnell, the past pattern of depositing spoil on the islands has been fortunate. Spoil is dumped periodically on some islands, returning vegetation levels to year one, he said. After drying, freshly dumped spoil becomes a perfect nesting site for royal terns.

But some environmentalists are calling for changes in the costly dredging operation, changes that could transfer much of the dumping to the mainland. Such changes, if begun, could threaten one of the very few remaining nesting sites for waterbirds requiring almost no vegetation.

Once the islands are covered with grasses, and later shrubs, thickets and trees, some of the water-

(See "Homes," page 5)

seascope

DR. THOMAS L. LINTON

Dr. Linton is director of the N.C. Office of Marine Affairs. Prior to assuming that position last fall, he served as Commissioner of the N.C. Division of Commercial and Sports Fisheries. Linton was on the University of Georgia faculty before coming to North Carolina in 1968.



Using our coastal resources wisely

North Carolina's coast is filled with a wealth of natural resources. As the beaches with their unique natural features become increasingly popular as vacation and living areas, it becomes a must that the state take action to insure that our limited coastal resources are conserved.

North Carolina is fortunate to have in operation mechanisms capable of guiding the wise use of our coastal resources.

State agencies, such as the N.C. Office of Marine Affairs, are charged with the responsibility of designing and putting into effect organized, long-range plans for managing the use of coastal lands and resources.

But before state administrators can design wise resource conservation plans, they must have a thorough understanding of the forces acting on the coastal areas—and the impact of these forces on natural resources.

For this information, they turn to the University, the institution with research capabilities to get at answers to coastal questions. University scientists, such as those supported by the UNC Sea Grant Program, are conducting research to learn exactly what resources we have, how they are affected by increased development, and what we can expect to happen to them in the future. They are also studying ways to develop coastal resources in a wise manner. Working closely with state agencies, University scientists help answer questions and solve problems brought to them from various agencies and the public.

Playing a central role in developing plans for coastal resource use is the N.C. Marine Science Council, a part of the Office of Marine Affairs. The Council has the responsibility of contributing direction, unity and continuity to the formulation and achievement of the state's goals and objectives relating to coastal resources.

The Marine Resources Center, with facilities under construction in Dare, Carteret and New Hanover Counties, will provide an arena for carrying out coastal resource management plans developed by the Marine Affairs office. A coastal planning section, now being established, will seek to achieve land and water resource management programs that integrate local, state and federal interests.

With the recent enactment of the Coastal Area Management Act, state agencies, the University and the public have been brought closer together in achieving wise land and resource use in coastal Carolina.

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Pest control course held

A two-day training course on mosquito and biting fly control in the coastal area May 8-9 attracted some 50 participants, representing all coastal counties.

Sponsored by the UNC Sea Grant Program and held at the Division of Commercial and Sports Fisheries in Morehead City, the course covered techniques for surveying and controlling mosquitoes, greenheads, yellow flies and sand flies. It was conducted by North Carolina State University entomologists, led by Dr. R. C. Axtell, and by the N.C. Department of Human Resources, Solid Waste and Vector Control Branch.

Participants reviewed state policies for insect control and pesticide safety. They were shown methods of sampling and monitoring to determine when and where insect populations are at their peak. In the area of specific controls, participants examined ULV, or ultra low volume, and discussed methods of ditching and impoundment.

Information covered at the course is available in the Sea Grant publication, "Training Manual for Mosquito and Biting Fly Control in Coastal Areas."

The manual, of potential interest to workers engaged in pest control, extension agents and fisheries and wildlife biologists, is available at the Program office.

Dolphin raised from egg

Attempts to raise the delicate dolphin fish from egg to juvenile have succeeded in research supported by UNC Sea Grant.

Research assistants, Bob Rainville and Harry Liner, working with Dr. Charles Mayo at the National Marine Fisheries Service laboratory in Miami, succeeded in rearing dolphin through the extremely vulnerable larval period lasting approximately 13 days. This is believed to be the first time juvenile dolphin have been raised from an egg in the laboratory.

The research, one aspect of Dr. W. W. Hassler's Sea Grant project to raise dolphin for food, sought to determine the conditions best suited for rearing dolphin. Efforts to improve rearing techniques are continuing.

Unearthing the secrets of N. C.'s geologic past

Over the years, North Carolinians who spent most of their days living next door to the Atlantic learned to respect their neighbor. Those that got to know her built their homes and shops in places protected from her gusting winds and tides.

But those who spent only a few weeks of each year in her company often put cottages right on her doorstep. The Atlantic didn't seem to care whose property she blew and washed away in her daily cleaning. In many cases, it didn't take her long to over run her neighbors' lands.

Many newcomers and summer people didn't understand their great neighbor. No one explained to them that shorelines are retreating about five to 10 feet per year, while sea level continues to rise.

lines. Even today, a picture of the geologic forces that shaped—and are still shaping—North Carolina's beaches is not complete. But a study in the Roanoke Island area by East Carolina University geologists, Drs. S. R. Riggs, and M. P. O'Connor, should add key pieces to the geologic puzzle of hope to better predict shoreline changes. coastal North Carolina. Their study is supported by UNC Sea Grant.

below the water's surface, where they are located and in what amounts.

to unravel the geologic processes that chiseled North Carolina's present coastline.

fossils found at various levels beneath the soil sur- ment.



(Photo by Jerry Machemehl)

Studies of geologic forces acting on the state's coast can help pinpoint areas where development might be unwise.

Nobody told them because nobody really knew face, Riggs and O'Connor have traced many of the the changes time had witnessed in the state's shore- changes shaping the state's coast for the past 40,000 years. Such forces as a rising sea level, constant shifting of the barrier islands and the periodic opening and closing of inlets and channels shaped today's shoreline, the researchers say.

From their evidence of the past, the geologists

Riggs and O'Connor believe their findings will provide sound bases for decisions on how coastal The research aims at learning what minerals lands should be used in the future. They will make and soils make up coastal lands both above and their findings available in a geologic atlas to be published later this year.

Wise coastal land-management hinges on an Tied closely to their study of soils is research understanding of the processes that have and will continue to act on coastal lands, Riggs and O'Connor contend. Their atlas will be aimed at informing Relying on old maps of the area as well as land-policy decision-makers of these processes and sophisticated tests and analyses of the soils and at providing guidelines for wise coastal develop-

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Changing dredge spoil to valuable marshland

To a lot of folks, the swampy marsh that separates hard, dry land from the Atlantic looks pretty worthless.

But scientists know that marsh offers more than meets the eye. The grasses that grow there and the tidal waters that flood the marshes offer nursery and nutrients for young, growing shrimp and fish.

Marsh, vital to the growth of many fish and shellfish, has shrunk alarmingly in recent decades, the victim of man's hunger for land.

Meanwhile, not far from the marsh, in the shallow sounds and estuaries between North Carolina's mainland and its Outer Banks, machines with long arm-like claws suck sand and mud from the bottom of channels and pump it onto beaches or into open waters. Dredging channels, keeping them deep enough for boats, is a never-ending chore. All too quickly, dredge spoil, having no grass or vegetation to hold it, makes its way back into the channel.

Years of costly dredging with its wear and tear on the environment, coupled with a mounting concern over the loss of marsh, has prompted a stern look at both problems. And for once, scientists figure they can "kill two birds with one stone."

The answer, they believe, is to turn dredge spoil into marsh by covering it with grasses that grow in the natural marsh, the most dominant of which is smooth cordgrass.

Supported by the UNC Sea Grant Program, the Center for Marine and Coastal Studies and the U.S. Army Corps of Engineers, Dr. W. W. Woodhouse, North Carolina State University soil scientist, began testing smooth cordgrass on dredge spoil in late 1971. Dr. E. D. Seneca, NCSU botanist, and S. W. Broome, research associate, have assisted in learning how smooth cordgrass (Spartina alterniflora) is established, grown and reproduced on spoil.

In the short time they have worked with the grass, the scientists have shown it can be a successful stabilizer.

According to the scientists, complete cover can be achieved with smooth cordgrass in two growing seasons. Seeding or transplanting can be used to establish a cover, and both have advantages. Seeding is fast and cheap, but transplanting is adaptable to a wider variety of conditions, the research-

Woodhouse, who for more than a dozen years has worked to stabilize N. C.'s sand dunes with beachgrasses and sea oats, has also turned his attention to halting eroding shorelines with marsh grasses. His work, aimed at building new marsh while stabilizing shorelines, holds promise for property owners whose beach-front lots are being gobbled up by winds and tides.



Smooth cordgrass is a successful stabilizer of dredge spoil and eroding shorelines.

Fighting marsh insects

Dunes, shorelines and spoil have enemies that are more secretive-and less direct-in their attack than winds and tides. Those enemies are the insects feeding on grasses that hold coastal lands in place.

Hoping to slow the guerilla-style warfare waged by certain insects, Dr. William V. Campbell, North Carolina State University entomologist and Sea Grant researcher, is studying their strategies.

His research focuses on a new species of scale insect (Eriococcus carolinae) found devastating American beachgrass south of North Carolina's Oregon Inlet.

Recently, Campbell has broadened his study to beetles that feed on smooth cordgrass, the dominant marsh grass in North Carolina, which is now being used to stabilize eroding shorelines and spoil. Early stages of this research are aimed at learning what effects, if any, the beetles have on marsh grass.

In his study of the scale insect, Campbell has found that in its larval, or immature, stage, the scale sucks the sap of beachgrass plants. Eventually the plants die, leaving the sand unprotected from winds.

Luckily, beachgrass is not alone in its battle against the scale's attack. Just one pound of active ingredient of the chemical dimethoate applied per acre wipes out the scale infestation, says Campbell. Once the pest is eradicated from an area, its return is slow since the female scale does not fly.

Campbell is also testing other control methods, including mixed plantings of a variety of grasses, controlled burning and application of a high grade oil.

A familiar insect in coastal Carolina, the Aedes mosquito.

Seeking wiser ways to control biting bugs

willing to put up with an overdose of sunshine.

But just let a few mosquitoes buzz into the campbecome a small torture chamber.

forever rid coastal areas of mosquitoes and all those other biting insects that can make beach are used as the problem worsens. vacations miserable, Sea Grant scientists are looking for better ways to at least lower their numbers.

North Carolina State University entomologists, Drs. Richard C. Axtell and K. L. Knight, are studyadvising local governments and citizens on more effective and environmentally sound ways to manage mosquitoes and biting flies. Fewer pesky insects could mean more tourists and more dollars for coastal businesses, they believe.

The scientists began their search for better insect control by asking coastal residents how bothered they are by the biting varmints and what birds have no other place to nest, Parnell points they'd like done about the problem.

To gauge the problem, they surveyed residents survey showed that a large majority of those responding are bothered often by biting insects. Eighty percent wanted more community effort devoted to insect control and most of those said they would be willing to pay for it.

The scientists paralleled the human survey with surveys of the pests to determine when and where they strike in greatest numbers. To learn more about the insects, Axtell and Knight have studied their life cycles, breeding sites and the conditions island management. that lead to large populations.

With data on peak population periods, it may be care is not taken to preserve their nesting sites.

Most sun worshippers and sports fishermen are possible to predict and prevent large numbers of the biting insects.

Pest management programs, combining a site. In a flash, that haven "away from it all" can variety of control methods and using them as pest populations reach peak periods, can save time and Although they're not making wild promises to money, according to Axtell. Instead of applying control measures on a regular calendar basis, they

Management schemes may combine cultural practices, biological controls and chemicals. An effective technique introduced to many local governments by Sea Grant researchers is ULV, or ing coastal insect control with the aim of better ultra-low-volume. Instead of "fogging", ULV sprays an almost invisible mist of selected insecticide. Monitoring and well-trained operators can be the key to ULV's success, researchers believe.

Homes for waterbirds

(Continued from page 1)

Facing prospects that dumping on dredge of Pamlico, Pender and Carteret Counties. The islands may undergo some changes, the scientists are turning their attention to "managing" the islands for continued use by terns and gulls.

Parnell and Soots believe it is possible to design islands suitable for several species of waterbirds by maintaining some bare areas, some grassy and some thicketed. The researchers lean toward selected herbicides for the best control of vegetation. With the U.S. Army Corps of Engineers, they are working on an island near Drum Inlet to test

The scientists aren't really sure where the water-Monitoring, the entomologists say, is central to birds nested before dredge islands were built, nor the success of any pest management program. With are they certain of the birds' importance in the precise information on the times and places pests ecosystem. But they believe that many of the are most severe, controls can be wisely applied. species are in danger of becoming "endangered" if

Fishermen hold annual meeting

More than 125 members attended the Sound and Sea Fisherman's Association's second annual meeting April 20 in Nags Head.

Keynote speaker was Dr. B. J. Copeland, director of the UNC Sea Grant Program. In his speech, Copeland outlined the activities and goals of Sea Grant in North Carolina.

He pointed out that Sea Grant studies aimed at stabilizing dredge spoil and eroding shorelines and research to find better ways to reduce populations of biting flies and mosquitoes in coastal areas should benefit fishermen.

Sea Grant also supports research to find better harvesting and handling methods, new ways to use seafoods, and improved processing techniques and markets, he told the group.

But Sea Grant's goals aren't met until research results are in the hands of those who need and can use them, the director said. A program of advisory services aims at relaying information from the lab to the coastal community and at taking questions back to the lab for research, he said.

Copeland urged fishermen to contact Sea Grant advisory personnel with problems and questions.

The Sound and Sea Fisherman's Association is a co-operative of some 250 small, independent fishermen in the Albemarle and Outer Banks regions. Organized two years ago with assistance from Sea Grant's continuing education program. the Association has made visible gains in reaching its goal of increased freezer and storage space. A 10,000 cubic foot freezer has been built in Wanchese, Association headquarters. Steps have been taken to acquire additional facilities for fish handling from Ocracoke to the Virginia border.

UNC SEA GRANT PUBLICATIONS

The following are publications produced by UNC Sea Grant dealing with research discussed in this newsletter. They are available upon request from the Program Office.

Marsh building with Dredge Spoil in North Carolina. W. W. Woodhouse, E. D. Seneca and S. W. Broome UNC-SG-72-10.

Public Rights and Coastal Zone Management. T. J. Schoenbaum. UNC-SG-72-

Public Opinion on Insect Pest Management in Coastal North Carolina, R. R. Gerhardt, J. C. Dukes, J. M. Falter and R. C. Axtell. UNC-SG-73-03.

Seacoast Plants of the Carolinas for Conservation and Beautification. K. Graetz, UNC-SG-73-06.

The Continental Shelf Lands of the United States: Mineral Resources and the Laws Affecting Their Development, Exploitation and Investment Potential. E. Dahle, UNC-SG-73-11.

Hydrographic Atlas of North Carolina Estuarine and Sound Waters, 1972. F. J. Schwartz and A. F. Chestnut, UNC-SG-73-12.

An Investigation of Propagation and the Mineral Nutrition of Spartina Alterniflora, S. W. Broome, W. W. Woodhouse and E. D. Seneca. UNC-SG-73-14.

Coastal Sediment Process Associated with a Major Transgressive System. S. R. Riggs and M. P. O'Connor. UNC-SG-74-04.

Training Manual for Mosquito and Biting Fly Control in Coastal Areas, R. C. Axtell. UNC-SG-74-08.

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University of North Carolina Sea Grant Program

NEWSLETTER

JULY, 1974

1235 Burlington Laboratories NCSU, Raleigh, N. C. 27607 Tel. (919) 737-2454

Coastal Management:

Planning today for tomorrow's resource needs

When it comes to the future of their state's coast, North Carolinians are at a crossroads.

Luckily, they have time to choose whether they will follow a road leading to beach areas that are free of clutter and rich in resources, or whether they will travel the route to certain destruction of coastal resources.

It's true that two-thirds of the state's shellfishing waters have been closed because of pollution. And much valuable marsh has been gobbled up by man's hunger for land.

But North Carolina's beach areas are still good places to live and vacation. Compared with other states, waters are relatively unpolluted. And clean, quiet beaches and good fishing aren't out of the ordinary.

This Spring, in steps that could help prevent the destruction of our limited resources, the N. C. General Assembly passed a law designed to encourage North Carolinians to plan for the use and conservation of coastal resources. Although the law, the Coastal Area Management Act, represents a new direction in coastal Carolina, no one can be sure just how effective it will be until it is in action.

The coastal bill remains a source of confusion to many citizens. Some believe the new law spells an end to growth for North Carolina's beach areas. Some see it as an attempt by government "to tell us what to do with our land." And others see the act as a direct threat to their rights as private property owners.

Just what does the coastal management act seek to do?

According to Dr. Thomas J. Schoenbaum, University of North Carolina associate professor of law, the law does not intend to stop growth. A clear



Hang gliding at Jockey's Ridge. Land management aims at protecting unique coastal features such as this large sand dune from unwise development.

policy of the act is to provide for orderly development of transportation, housing, industrial, commercial and recreational facilities, he notes in article that will appear in the Fall, 1974 North Carolina Law Review.

While the bill calls for continuing development, it also sets a clear policy for preserving and managing the natural environment, Schoenbaum says, pointing out that a comprehensive management plan is the key to resolving the conflict between development and conservation.

Schoenbaum, a Sea Grant researcher and a primary author of the coastal bill, explains that the act divides coastal lands and waters into two broad

(See "Planning," page 3)

seascope

REP. WILLIS P. WHICHARD



Rep. Whichard (D-Durham) served in the N. C. House of Representatives during 1973-74 as chairman of the House Committee on Water and Air Resources. He was one of two key co-sponsors of the Coastal Area Management Act in the General Assembly.

Coastal zone management in North Carolina

The 1969 General Assembly, recognizing the critical problems of development in North Carolina's coastal region, established and funded a study commission on coastal area management. The Coastal Area Management Act introduced in the 1973 Session was the product of that Commission.

Because of considerable interest in this legislation, the bill was held over for further hearings and study between the 1973 and 1974 sessions. A joint Senate-House Committee held day-long hearings in five cities in the coastal area. The bill was then the subject of further scrutiny by the committee, which resulted in submission of a re-drafted bill to the 1974 Session. After further committee action and numerous floor amendments, the bill was finally enacted two days before adjournment.

The bill establishes a cooperative program between state and local government for management of future growth in the coastal area. State government establishes areas of environmental concern. Local government has the initiative for planning, with state government acting in a supportive standardsetting and review capacity. Enforcement is a concurrent State-local

responsibility.

Two new state level agencies are established. A Coastal Resources Commission, consisting of 15 members appointed by the Governor (12 from nominees submitted by counties and cities in the coastal area; three with no restrictions), approves land use plans submitted by the counties, designates areas of environmental concern and approves or denies permits for major development within those areas. (Permits for minor development are issued at the local level, subject to appeal to the Commission). A Coastal Resources Advisory Council, consisting of not more than 47 members, most of whom represent state and local government, assists the Secretaries of Administration and of Natural and Economic Resources in an advisory capacity.

The bill contains standards for designating areas of environmental concern and for granting or denying permits for development within these areas. These standards were carefully drafted after consideration of the land use statutes of other states as well as the particular problems of North Carolina. The bill also contains provisions for expedited court proceedings to determine whether the denial of a permit for development amounts in practical effect to a taking of property for which the landowner must be compensated.

While this bill, like all major legislation, is the product of compromise, it represents a significant step for North Carolina in the area of land use planning and regulation. The Governor has now designated 20 counties to be subject to the provisions of the act. These counties and the qualified cities therein have submitted their nominations for the Commission. If the Governor makes his appointments wisely, and if the State and local governments fulfill their responsibilities, this act can aid significantly in preserving and promoting the orderly growth of North Carolina's coastal region.

Conference draws management views

Maintaining open lines of communication among federal, state and local governments and citizens of coastal North Carolina emerged as a major concern at a recent conference on coastal land management.

The conference, held May 16-17 at the Duke University Marine Laboratory in Beaufort, attracted more than 200 participants. It provided a forum for the land management views of state and local governments, the public, planners, developers and the financial community.

Dr. Lynn Muchmore, state planning officer, stressed the importance of examining the effects of regulations on coastal people. "The people are the most important factor in coastal management. Polluters have been getting indirect subsidies in the past by the public. We must make sure the costs of management to curb pollution don't fall on those least able to pay," he said.

Joe Porter, president of Design Workshop, addressed the interests of consultants. He urged that "a process be developed in which people can continue to communicate over time to answer questions that arise. not just communicating when a

crisis occurs.

UNC-Wilmington social work instructor, Delilah Blanks, charged that "the Coastal Area Management Act is useless unless some changes are made. Poor whites, blacks and minorities must be able to share in coastal living and decisions. Now they are given no role in policy formulation," she said.

The conference was sponsored by the UNC Sea Grant Program, the Center for Marine and Coastal Studies, the Coastal Plains Center for Marine Development Services and the NCSU Division of Continuing Education.

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Planning for tomorrow

(Continued from page 1)

categories—areas of environmental concern and all other areas. Environmentally sensitive areas, to be designated by the state Coastal Resources Commission, include wetlands, dunes, estuarine lands and waters, watersheds, wildlife, scenic and historic sites, and areas where the public may have special rights or where development may be hazardous.

Under the act, the state is charged with regulating development in areas of environmental concern. In all other areas, the management law allows county and city governments to determine uses for lands and waters, the professor points out.

The act calls for each of the 20 coastal counties to submit a plan for development by December 1, 1975, to the state Coastal Resources Commission (CRC). If a county fails to comply, the state will develop a plan for that county.

The CRC, a new state agency established by the coastal act, is charged with reviewing and approving county plans, Schoenbaum points out. The 15-member commission, chosen by the governor, is to be made up of 12 local government nominees.

In order to build on or develop an area of environmental concern, the developer must apply for a permit, according to the new law. Where he applies depends on the size of his development and on whether it presently requires approval from a state agency. Schoenbaum explains that permits for major developments must be obtained from the state CRC, while permits for minor developments are to be granted by local governments.

A major development, according to the law, occupies more than 20 acres, consists of a structure of more than 60,000 square feet or meets conditions presently requiring a special state permit, such as for dredging or filling of marshlands. Minor developments include all others.

Law students study issues of international sea law

Most North Carolinians will probably never see the foreign ships that fish regularly off their state's shore.

But as world food and mineral supplies dwindle and nations scramble to grab the sea's bounty, North Carolinians are likely to hear more about fishing and mining rights in the ocean.

Students at the University of North Carolina School of Law have delved into a wide range of ocean-related issues confronting all nations. Their research into offshore disputes that have flared in the past promises to help guide the thinking of policy-makers at both the state and national levels as they regulate activities off their coasts.

Dr. Seymour W. Wurfel, UNC law professor who



North Carolina fishermen are likely to meet more competition from foreign fishing vessels in the future. UNC law students are studying ocean law to learn more about fishing rights issues facing the state and nation.

has support from Sea Grant, has directed the students' legal research. Through their efforts, the students, many of whom are now practicing law, have become acquainted with the law of the sea. At the same time they have made significant contributions to an understanding of ocean issues through publication of their studies.

Much of their research has focused on the conflict over how far offshore a nation can claim exclusive fishing rights. Most coastal nations have agreed that other countries cannot fish or mine in waters within 12 miles of their shore. But to protect and conserve their fishery resources, 12 nations have extended their exclusive fishing rights to 200 miles offshore. Iceland, aiming at guarding her cod fishery, set her fishing rights at 50 miles in 1972, a move which brought on the second "cod war" with England.

As nations increasingly turn to the sea for minerals, foods and other resources, it becomes essential that to avoid conflict all nations share in the seas' wealth and that all realize that their activities on the high seas affect the entire world. Law students have analyzed the possibilities and problems of developing a set of international rules to regulate the exploitation of the oceans and to insure that all nations share in ocean resources. They have also studied how polluting or fishing activities of one nation affects all.

A United Nations conference in Caracas, Venezuela this summer will seek to resolve some of the problems UNC law students have defined and discussed in their research. At the conference, nations will try to agree on the limits of exclusive fishing rights and on international regulations governing the use and conservation of ocean resources.

Even though the issues sound far removed from North Carolinians today, they will likely be affected by them tomorrow.

Workshop marks first step toward managing islands

Dredge islands in North Carolina's estuaries are valuable nesting sites for waterbirds such as gulls, terns and egrets, Sea Grant researchers have found.

In a workshop held at Atlantic Beach in late May, steps were taken that could set the stage for

managing dredge islands for the birds.

Some 70 workshop participants, representing 25 agencies and organizations and seven states, heard a review of research conducted on the islands by Sea Grant researchers, Dr. James Parnell of UNC-Wilmington and Robert Soots of Campbell College.

In addition to exploring the legal, financial and engineering aspects of managing dredge islands for the birds, workshop speakers reviewed the biology of the birds and the effects of management on the estuarine environment.

A field trip to the dredge islands where the waterbirds were nesting was a highlight of the workshop.

It was pointed out during the workshop that dredge island management is already being carried out in a cooperative effort by the U.S. Army Corps of Engineers, Wilmington District and Sea Grant researchers, Parnell and Soots.

But participants concluded that a more comprehensive management program is needed and that responsibility for such a program should lie with an agency charged with resource management throughout the ecosystem, not just on the dredge

islands.

It was agreed that a lack of knowledge of the number of birds nesting in North Carolina and other states could hamper the effectiveness of a management effort.

The workshop was jointly sponsored by Sea Grant and the N. C. Agricultural Extension Service.

UNC SEA GRANT PUBLICATIONS

The following are publications produced by UNC Sea Grant relating to coastal management and the law of the sea. They are available from the Program office.

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SG-72-02.

Public Rights and Coastal Zone Management. Schoenbaum, T. J. UNC-SG-

The Surge of Sea Law. Wurfel, S. W. UNC-SG-73-01.

The Latin American Approach to the Law of the Sea. Samet, J. H. and R. L. Fuerst. UNC-SG-73-08.

The Continental Shelf Lands of the United States: Mineral Resources and the Laws Affecting their Development, Exploitation and Investment Potential. Dahle, E. UNC-SG-73-11.

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Current Aspects of Sea Law. Wurfel,

S. W. UNC-SG-74-03.

State and Federal Jurisdictional Conflicts in the Regulations of United States Coastal Waters. Suher, T. and K. Hennessee. UNC-SG-74-05.

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SG-74-06.

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University of North Carolina Sea Grant Program

NEWSLETTER

AUGUST, 1974

1235 Burlington Laboratories NCSU, Raleigh, N. C. 27607 Phone: (919) 737-2454

At Sea Grant:

Setting goals for tomorrow

It's not too unusual to hear about a university scientist doing research on the coast. Most of the time you hear he's studying pollution or trying to find out more about the ocean—all of which is important for properly using and conserving natural resources.

But while scientists have devoted attention to fish and other coastal resources, little effort has gone toward studying the social, legal and economic pressures bearing on the people—the human resource—of coastal Carolina.

Realizing that to plan wisely, the impact of pressures on all resources needs careful study, the University of North Carolina Sea Grant Program is proposing support for legal and socio-economic studies, in addition to seeking continued funding for studies aimed at learning more about the coastal resources and how to use them wisely.

This month, UNC Sea Grant submitted a proposal for support to the National Sea Grant Program in Washington, D. C. The proposal sets forth research, advisory services and education goals which the North Carolina Program hopes to achieve in 1975-76. After careful review of the proposal, and a visit to North Carolina in October to hear more about Program goals, the National Sea Grant office determines which of the 25 projects included in the North Carolina proposal merit funding.

Following is a summary of the UNC Sea Grant Program goals for the next two years in the areas of aquaculture and fisheries, seafood science and technology, education and advisory services, legal and socio-economic studies and coastal zone and estuarine studies.



Studies are planned to anticipate the effects of change today's children are likely to see occur on North Carolina's coast.

Aquaculture and fisheries

Aquaculture, or fish farming, may provide part of the solution to a growing world food shortage. But as yet, farming fish and other food organisms of the sea is a science filled with problems.

Through research, Sea Grant is trying to help get rid of some of the "bugs" that are holding up fish farming. In the coming year, which marks the fifth and final year of this study, Sea Grant is proposing to continue learning more about diseases, particularly fungal parasites, that attack blue crab, penaeid shrimp and other crustacea off North Carolina's coast. With information on how widespread the parasites are, where they are found and how they affect the abundance of marine crustacea, scientists believe they can find ways to control them in confined, crowded aquaculture conditions.

Eels could be a money-maker for coastal North Carolinians who learn to grow, harvest and market them. Sea Grant scientists are also proposing studies to further develop eel aquaculture techniques for use in this state.

seascope



Dr. B. J. Copeland

Dr. Copeland has served as director of the UNC Sea Grant Program since July, 1973. As director, he sees that individual research, extension and education projects remain directed toward the program's goals of increasing and improving the use of coastal and marine resources in a wise manner.

Preparing for UNC Sea Grant's fifth year

The University of North Carolina has prepared a proposal to the Office of Sea Grant for the fifth year of institutional Sea Grant support. We have prepared a program proposal containing 25 projects, consisting of research in a wide spectrum of coastal resources, aquaculture, seafood science and technology, legal, socio-economic, coastal zone and estuarine studies and advisory services.

Our proposed program is in response to a wide variety of needs for understanding, managing, and conserving North Carolina's coastal resources. Heretofore, we have concentrated our efforts in commercial fishing, seafood science and technology and estuarine studies, but we want to add new areas of research and advisory services. With the recent passage of the N. C. Coastal Area Management Act, we are proposing to develop research in the areas of coastal zone studies and legal and socio-economic studies. These two new areas of research reflect the need to combine engineering, economic, sociological, legal and ecological research and advisory services to assist in the proper and expeditious implementation of coastal zone management.

In developing our University Sea Grant Program for the next two years, we have followed a complex sequence of activities. It all started during the winter when we arranged with state agency directors to determine areas where their needs and our expertise could come together. These findings were balanced with feedback from "users" through advisory groups and planning groups. The next step consisted of discussing these needs with and obtaining suggestions from University research, education and extension groups at the four campuses involved in the Sea Grant Program. From these inputs a program of action was constructed.

Finally, after individual proposals had been received they were evaluated by a special review board, the University Marine Science Council, N. C. Marine Science Council and relevant state agencies. Based on review results, 25 of the 44 proposals submitted were selected to best reflect the Sea Grant Program and constitute our institutional proposal. The final step will be taken in October when a team of experts from the Office of Sea Grant will visit North Carolina to review and discuss the program and recommend funding for the approved projects.

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Studies in N.C.'s coastal zone

North Carolina's Outer Banks and coastal areas are undergoing rapid development. Sea Grant is proposing projects aimed at helping manage growing pressures on the coastal environment.

One project is seeking support to study currents and the forces and energy generated by waves and currents in Onslow Bay, an area from Cape Lookout south to Cape Fear. This study could lead to a model for pinpointing good places for waste outfalls, deep-sea ports and predicting rates of beach erosion and inlet stability.

Scientists are also proposing to continue their research to stabilize dunes and dredge spoil with vegetation. Another has proposed to further develop ecologically sound ways to control mosquitoes and biting flies in coastal areas. And a geologist is proposing a study to determine the rate at which shorelines on the Sound side of the barrier islands are moving each year.

Learning more about estuaries

North Carolina's estuarine areas furnish habitat for wildlife, particularly waterbirds, and offer nutrients essential to the production of many species of fish and shellfish. Sea Grant is seeking to learn more about estuarine resources and their proper management.

In one project, a biologist is seeking support to determine how many waterbirds nest on North Carolina's hundreds of dredge islands. He also plans to evaluate how physical changes on the islands affect bird populations. A coastal atlas showing where bird colonies breed and indicating the relationship of each species to its habitat is part of the proposal.

In two other studies, scientists are proposing to determine how much marsh grasses are worth to the nourishment of shrimp and other fishery species. These studies provide useful information to planners making decisions on whether the costs to the fisheries industry would be too great to justify draining and filling marsh for development.

Delving into economic, social and legal issues

Hoping to come to grips with problems confronting North Carolina's citizens, Sea Grant is proposing a variety of social, legal and economic studies.

While most research has dealt with the effect of increased tourism on coastal resources, a sociologist has proposed studying its impact on coastal communities and their citizens. During the next two years, the researcher plans to monitor how the fuel shortage, the coastal management act, the bicentennial year and the foreign purchase of large blocks of coastal lands affect coastal communities. Results of this project, built into a mathematical model, should help local coastal governments anticipate changes development may bring.

The N. C. General Assembly recently passed the Coastal Area Management Act, legislation aimed at encouraging counties to plan how lands will be used and protected in the future. No one is quite sure how effective the new law will be. A Sea Grant legal investigator is seeking support to study the new law's effectiveness and to determine how it

could be improved.

Another legal investigator is proposing to continue analyzing the legal aspects of developing off-shore ports and mineral and petroleum resources in the oceans. He also plans to analyze the impact of treaties, federal and sister-state laws on fishing operations in ocean areas near North Carolina as well as national security interests in the oceans.

In some areas of North Carolina, the public is denied free access to beaches. One researcher proposes to analyze the rights of the public to get to and use beach areas. This study will also involve looking at the laws of other states dealing with access to beaches and developing access policies for North Carolina.

Under a project which proposes to study the economics of coastal zone management, an economist plans to begin putting together a mathematical model that can be used to compare gains and losses before decisions on resource management are put into effect. For example, with the model researchers could predict the costs and benefits of resort development in a marsh and compare those figures with predicted dollars-and-cents losses to fisheries.

Another economics study proposes to trace the channels that fresh seafood follow from the North Carolina fisherman to the final distributor. The researcher plans to identify problem areas in seafood marketing and to pinpoint channels to take fresh seafood from North Carolina into interstate commerce. A major goal is to provide useful information to prospective processing plant investors

In other proposals, investigators are seeking

How does UNC Sea Grant go about getting money to study coastal problems? The process goes something like this.

A scientist hears of or sees a problem relating to the coastal area. He thinks he could study the problem and do something about it, but he needs money to cover research expenses.

He submits a written proposal to UNC Sea Grant, spelling out what he believes the problem is and what he thinks he can do

to help solve it.

If his proposal meets with the approval at the UNC Sea Grant level, it is sent to the National Sea Grant Program Office in Washington, D. C. for careful review. A review team, made up of scientists or engineers from universities, government and private industry, evaluate the proposed research.

To learn more about the proposed study, the review team visits North Carolina in October to further question the researcher on his proposal and to offer helpful suggestions.

Taking into account the reviewers' recommendations, the National Sea Grant Office makes decisions on funding for each

proposal.

In North Carolina, researchers submit proposals in the early spring. If the proposed study meets favorably with reviewers and the National Office during the October site visit, funding may begin in January of the following year.

funding to define and measure the economic benefits of investing in port facilities in North Carolina and to study the economic feasibility of expanding intracoastal shipping. The latter project will involve determining demand for intracoastal shipping, examining existing facilities and determining if expansion is justified. If it is, he plans to pinpoint specific directions expansion might take from the private and public sectors.

Advisory services projects

Advisory services is the information link between you and the laboratory.

During the next two years, Sea Grant is seeking funding to expand its advisory services to coastal communities battling mosquitoes and biting flies. Researchers propose offering training courses and on-the-job guidance to insect control agents in coastal counties as they develop and put into action ecologically sound pest management programs. They are also aiming to provide advisory services in land-use and recreation.

(Continued on next page)

From the laboratory to you

(Continued from page 3)

In addition, Sea Grant advisory specialists are proposing to continue serving commercial and sports fishermen, seafood processors and others who can put research results to work.

Engineering advisory services investigators are seeking support for ongoing engineering assistance to the seafood industry and coastal recreation.

Continuing education project leaders plan to continue assisting commercial fishermen develop improved marketing, expanded fishing options and more productive fishing. Another goal is to provide services to all users of marine resources.

The science of seafood

Getting the most out of the catch—whether by making new products from "trash" fish or by reducing the threat of disease and contaminants in seafood—is the business of seafood scientists.

For 1975-76, seafood researchers are asking for support to continue developing new products from fish and crab meat which has been mechanically deboned or separated. They plan to investigate changes in fish tissue resulting from mechanical deboning and to develop less wasteful ways to process fish tissue.

Another part of their research plan is to study the deterioration of crab meat quality during frozen storage and determine what is needed for a good system of freezing crab meat. They also aim to seek ways to improve crab meat shelf life and sanitation. A series of publications detailing their research results which should be of immediate assistance to the industry is proposed.

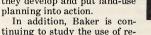
Other scientists are seeking support to survey seafoods for bacteria, such as salmonella and clostridium, and trace metals, such as copper, mercury and cadmium, which can cause sickness and death. As part of their research, they will experi-

ment to find ways to control bacteria and heavy metals during processing.

Land-use specialist joins Sea Grant staff

Dr. Simon Baker, whose study of aerial and space photography as a guide for land-use planning has attracted international attention, joined the UNC Sea Grant Program staff July 1.

He is serving as a Sea Grant advisory agent dealing specifically with land-use problems in North Carolina. He will be working closely with local communities and with state and county governments as they develop and put land-use planning into action.





Baker

mote sensing in land management and is affiliated with the North Carolina State University School of Design in landscape architecture.

Baker comes to North Carolina from Florida Atlantic University where he has been associate

professor of geography since 1968.

The new Sea Grant advisory agent was a geographer with the U. S. Department of Agriculture from 1966-68. During that time he conducted research and published articles relating to the new technology of remote sensing and its potential in gathering land-use and agricultural information. Remote sensing involves the use of aerial photographs and images of the earth transmitted from satellites and Skylab.

Working with the Photographic Survey Corporation of Toronto, Baker was employed in Ceylon in 1957-58 as the land-use member of a team of specialists studying the resources of a river basin.

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University of North Carolina Sea Grant Program

NEWSLETTER

SEPTEMBER, 1974

1235 Burlington Laboratories NCSU, Raleigh, N. C. 27607 Tel. (919) 737-2454



the most of your catch

Mrs. Monna Jean Styron perched behind the counter at the Morehead City Yacht Basin, making change and chatting with customers. Out the window behind her, rows of proud white boats, spiffed up like sailors ready for inspection, stood at attention.

Mrs. Styron owns and operates the business she and her late husband, W. L. "Bump" Styron, took over more than a quarter century ago. Over the years, the Styrons had to expand their business—largely because more people discovered the fun of fishing. From her seat in the window, Mrs. Styron has watched sports fishermen haul tons of fish onto her docks. And each year it seemed they brought in more.

Although it's tough to determine how much fish non-commercial fishermen bring in each year, conservative estimates say that 25 per cent of the state's commercial catch is landed by sportsmen.

But too often, the fate of "the big ones we hauled in" is never told to the guys back home. Too often, Mrs. Styron and others have seen the sports catch wasted.

Some fishermen, courting visions of a handsome trophy hanging above the fireplace, don't consider their sport a quest for food. But according to Mrs. Styron and Ted Miller at the Sea Grant Seafood Laboratory in Morehead City, most sports fishermen who waste their catch just don't know how to

keep it fresh. And if they do, wives back home often aren't sure how to handle, freeze and cook fish so it tastes best.

Immediate chilling is the key to fresh fish, according to Sea Grant advisory agents. Fish should be iced before it dies, or at the longest, within a few hours of the catch. Miller, who works closely with Sea Grant seafood researchers, recommends a salt and ice mixture for speedy chilling. Advisory agents are also encouraging party boats to carry more ice.

Processors, too, are increasingly interested in the sports catch, Miller says. Trends point to processors serving both sports and commercial fishermen, he adds. In Morehead City, Capt. Ottis's processing plant—complete with scaling machine—scales, fillets and packs fish in ice for a fee and is willing to buy King Mackerel and other kinds of fish from non-commercial fishermen.

Sea Grant-supported research is also trying to help the housewife when her sportsman returns with unusual varieties of fish. Each month at the Seafood Laboratory, Mrs. Styron and 11 other Carteret County women pool their cooking skills to create new fish recipes and find out more about seafood likes and dislikes. Results of their activities are taken to each of the home demonstration clubs they represent.

(See "Preserving," page 4)

The men who keep Sea Grant in tune

UNC Sea Grant has asked the National Sea Grant Office in Washington, D. C. to furnish support for 25 projects over the next two years.

Making sure that all the projects, spread over four university campuses, are running smoothly is a mammoth task for one man. So UNC Sea Grant divided the projects into six groups and appointed six men to oversee activities in each

group.

Sea Grant calls these men "area coordinators." Those chosen for 1975-76 are scientists with expertise in the area they head. One of their jobs is to alert investigators in their groups to activities of researchers doing related work. Another is to keep studies in harmony with Program goals, a responsibility which means communicating between researchers and Program administrators.

Area coordinators are also called upon to help develop a Sea Grant Program of research, advisory services and education which meets the needs of the people of North Carolina. In addition, the coordinators strive to keep Sea Grant in tune with goals of the University and other state and University programs.

Through their efforts, the coordinators provide expertise and leadership necessary to Sea Grant's

success

Dr. Rickards

The assistant director of the UNC Sea Grant Program will oversee aquaculture and fisheries research for the coming two years.



Dr. William L. Rickards, a marine scientist whose specialty is fisheries, joined the UNC Sea Grant staff as assistant coodinator in 1971. He was named assistant director last year.

In addition to carrying out administrative duties for Sea Grant, Rickards is a visiting

assistant professor of zoology at N. C. State University. From 1971-73, he was a research associate at the Department of Environmental Sciences and Engineering at UNC-Chapel Hill.

The author of more than half dozen publications on aquaculture and fisheries, Rickards earned an A.B. in biology at the University of Delaware, an M.S. in zoology at the University of Georgia and a Ph.D. in marine sciences at the University of Miami.

Dr. Hammond



Dr. Leigh H. Hammond willowing act as coordinator of Sea Gratal services during 1975-76. He is size chancellor for extension and policy and is acting director of the Cenful Affairs and Community Services 100

Sea Grant advisory services of aimed at getting research resus to who can put them to use. In wisory agents take questions sed dividuals, companies and community to the lab for study.

Hammond's involvement in catal goes back to 1969 when he was point rector of the Coastal Plains Report mission for North Carolina. See that served as co-chairman of the marine resource planning grous is ber of the North Carolina Milks

Dr. Webb



Dr. Neil B. Webb, North Carolina State University associate professor of food science, will coordinate activities in the area of seafood science and technology during 1975-76. Research in this area seeks answers to problems confronted by all seafood users—from fishermen and processors to consumers.

Webb has had support from Sea Grant since the Program's initiation in North Carolina in 1970. His research has covered a wide range of problems relating to seafood quality, the use of underutilized species in new products, processing and seafood processing sanitation.

Webb has worked in both university and industry and has co-authored a number of publications dealing with seafood science and technology. Prior to coming to N. C. State in 1966, he was director of technology at The Eckerl Packing Co. in Defiance, Ohio.

He holds a B.S. degree in animal science from West Virginia University and M.S. and Ph.D. degrees in meat science from the University of Illinois and the University of Missouri.

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astal affairs spointed di-Reional Com-Sice then he hetate-federal ou as a mem-Maine Science Council and as the Governor's designee as North Carolina's contact with the National Oceanic and Atmospheric Administration

for coastal zone management.

An economist, Hammond was deputy secretary of the N. C. Department of Administration under Governor Robert W. Scott. He was a chief architect of plans for the Council on State Goals and Policy and he chaired a state government effort to develop a system of multi-county planning regions. Hammond also served as chief coordinator of the State Marine Resources Development Programs.

Prior to working in state government, Hammond was an associate professor of economics at NCSU. He earned degrees in agricultural economics at Clemson University and the University of Tennessee and in

economics at N. C. State University.

Dr. Brown

East Carolina University's director of Institutional Development, Dr. C. Q. Brown, has been selected to coordinate Sea Grant's legal and socioeconomic studies for the coming two years.

Proposed research for 1975-76 includes studies to learn more about legal, social and economic pressures confronting coastal residents and communities.

Brown is one of the founders and was the first chairman of the ECU Department of Geology. As such, he was an early leader in promoting coastal research. In establishing ECU's geology department, he

stressed faculty involvement in coastal geology.

As director of Institutional Development, Brown is responsible for seven offices offering campus-wide services.





Dr. Langfelder

North Carolina's coast is a complex area, characterized by constant, and rapid, change. Sea Grant has proposed research to learn more about our coast, with the aim of providing insight into pressing problems.

Dr. L. Jay Langfelder, director of the Center for Marine and Coastal Studies at N. C. State University, will guide Sea Grant's coastal zone studies for 1975-76. His involvement in marine affairs through university and public service places him in a unique position to spot problem areas and direct

research to seek solutions.

A professor of civil engineering at NCSU, Langfelder serves on some 10 committees which deal directly with marine and coastal matters. He serves as a member of the University of North Carolina Marine Science Council, the administrative committee for the N. C. Marine Resources Center, the technical committee of the state's Water Resources Research Institute and the technical advisory committee for the joint state-federal marine resource planning committee.

The author of articles on coastal erosion, Langfelder was educated at the Universities of Florida

and Illinois.

Among them are the Office of Sponsored Programs, the Office of Institutional Research and the Regional Development Institute. He has held his present post since 1969.

Brown earned B.S. and M.S. degrees at UNC-Chapel Hill and a Ph.D. at Virginia Polytechnic

Institute.

Dr. Copeland



UNC Sea Grant Program Director Dr. B. J. Copeland will temporarily serve as coordinator of estuarine studies. A permanent coordinator will be appointed to the position later this year.

Estuarine research, proposed by UNC Sea Grant for 1975-76. includes an inventory of waterbirds nesting on North Carolina's dredge islands and an evaluation of how changes on the islands affect bird populations.

Other proposed studies are aimed at determining how much decaying marsh grasses are worth to the nourishment of shrimp and other fishery

Copeland, a professor of zoology, botany and marine sciences at NCSU, had led estuarine studies in connection with research relating to the effects of nuclear power plant construction in coastal areas.

He became Program director in 1973.

Before coming to N. C. State in 1970, Copeland was a visiting associate professor at UNC-Chapel Hill and at the UNC Institute of Marine Sciences. Prior to that, he was associated with the University of Texas Marine Science Institute at Port Aransas. Copeland was educated at Oklahoma State University.

Avoid fishy flavors; try superchilling

Superchilling, or reducing the temperature of fish to just above freezing soon after it is caught, can prevent that "fishy" flavor. Sea Grant advisory agents say that superchilling, outlined below, can enable you to hold your catch for up to seven days without loss of quality.

Here's how to superchill:

1. Take along a large insulated picnic box containing an adequate supply of crushed ice. Carry a supply of coarse salt separately.

2. While fish are still flipping, remove all but four (4) inches of ice from container. The ice left in the box is not to be salted, but keeps fish off the bottom of the container.

3. Mix the ice you took out of the box with salt, using one pound of salt per 20 pounds of ice.

4. Arrange the fish in layers in the insulated box with the salt-ice mixture applied liberally between each layer.

Preserving your catch

(Continued from page 1)

Seafood recipes, compiled by the N. C. Department of Natural and Economic Resources Seafood Marketing Division, are available from: Seafoods, Department of Natural and Economic Resources, P. O. Box 27687, Raleigh, N. C. 27611.

County home extension agents may be of further help with seafood cookery. A booklet, "Fish and Shellfish For Your Table," is available from Dr. Frank B. Thomas, 129-F Schaub Hall, N. C. State University, Raleigh, N. C. 27607 or from Seafood Laboratory, P. O. Box 51, Morehead City, N. C. 28557.

University of North Carolina Sea Grant Program 1235 Burlington Laboratories North Carolina State University Raleigh, North Carolina 27607



Dip fish to lock out rank odors and tastes

It's a real setback when you've got your mouth watering for some good seafood, only to discover that the fish you froze a few months back has a rank smell and taste.

Sea Grant scientists recommend applying a dip solution to whole, dressed or filleted fish before wrapping in protective plastic and freezing. They say the solution helps keep fish tasting, smelling and looking fresh because it slows the interaction of oxygen with fish fats.

To make the solution, you'll need:

- 2 tablespoons unflavored gelatin
- 2 tablespoons + 1 teaspoon ascorbic acid
- 4 fluid ounces lemon juice
- 28 fluid ounces water

Stir gelatin into eight (8) ounces of cold water. Heat remaining water, lemon juice and ascorbic acid to near boiling. Stir cold gelatin mixture into hot liquid until it is almost clear. Cool the dip solution to about room temperature before use.

Dip and drain fish. Then wrap in plastic. To wrap, tear off 12 to 18 inches of plastic. Lap plastic over sides, then ends.

Whole fish, if fairly small, may be arranged "sardine" style. Fillets should be packed with meat side away from folds. If freezing on a small scale, researchers recommend placing packages, folds downward, on a metal tray.

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University of North Carolina Sea Grant Program NEWSLETTER

OCTOBER, 1974

1235 Burlington Laboratories NCSU, Raleigh, N. C. 27607 Phone: (919) 737-2454



Capt. Moon Tillett surveys the catch as the nets come in.

A hard year for shrimpers

Capt. Moon Tillett stepped out of his white rubber boots and planted his feet in the same spot they've stood for a good part of the past 10 years. From his post behind the wheel of the Capt. John Duke, Capt. Tillett once again studied the horizon he's known since he was just a toddler.

It was August—hot, humid and hazy. The John Duke, Capt. Tillett's handsome shrimp boat, plowed through the waters of Far Creek, leaving the fishing village of Engelhard for the wide, open spaces of the Pamlico Sound. The skipper's deep-set eyes danced across the waters beyond. But from the look on his face, you could tell he was thinking of one thing—hauling in some shrimp. For North Carolina's commercial fishermen, shrimp is the crop that pads their pocketbooks.

Perhaps more this year than last, Capt. Moon had his mind on his work. "This year is the worst market we ever had. We're getting 1948 prices," he said as the breakers rocked his boat. "Our income is cut in half from last year and our expense is doubled."

The price of everything a shrimper needs—diesel fuel, oil, ice and groceries—is up since last year, Capt. Tillett said in a mid-August

(See "Fishermen," Page 5)

Fishermen: University and government are aware of needs

To the fisherman whose life centers around his boat, his work and a marketplace that seems to stack the cards against him, it may seem that his needs have been ignored by government and universities.

But even though individual fisherman may not immediately see or feel the results, the University and state and federal agencies are working to make North Carolina's fishing industry healthier.

On the University level, the Sea Grant Program, the N.C. Agricultural Experiment Station and scientists associated with the UNC Institute of Marine Sciences, the Center for Marine and Coastal Studies and a wide range of disciplines are leading research that could have a long-term impact on N.C. fisheries. Extension and advisory services are provided for fishermen by Sea Grant and the N.C. Agricultural Extension Service.

On the state level, agencies within the N.C.Department of Natural and Economic Resources are working to protect and conserve the state's fishery resource and to bolster the fishing industry.

Two agencies primarily responsible for statesupported marine activities are the Division of Marine Fisheries, formerly called the Division of Commercial and Sports Fisheries, and the Seafood Industries Section of the Division of Commerce and Industry.

The goal of state and university programs is to assist all aspects of the marketing chain, from fisherman to consumer. Administrators believe that assistance at any point in the chain—whether to fishermen, dealers, wholesalers, processors or retailers—will eventually benefit the entire industry and the coastal economy.

At the federal level, the National Oceanic and Atmospheric Administration (NOAA) supports the National Marine Fisheries Service (NMFS) which has a lab in Beaufort and the Sea Grant Program. Work at NMFS centers around conserving and ensuring the wise use of important commercial and game fish and their environments.

The National Marine Advisory Service (NMAS), also a part of NOAA, works closely in an advisory capacity with commercial fishermen and NMFS. Among advisory services provided by NMAS is assistance to alleviate fuel allocation problems in the fishing industry.

The Coastal Plains Regional Commission (CPRC) is a regional organization whose aim is to bolster coastal economies in the Carolinas and Georgia. Assisting the fishing industry is one way CPRC seeks to achieve its goal.

Help is available for fishermen with a question. But knowing where to go for answers to questions on gear, marketing, repairs, finances and other problems relating to your fishing business isn't always easy.

The following is a list of university and state programs, what they have to offer and the people associated with them who may be able to lend a hand or at least lead you to someone who can.

SEA GRANT

-Continuing education for fishermen:

Short courses are held periodically to update fishermen on new equipment, its use, business management, new fisheries options and a variety of other subjects of interest to the fishing community. If you are interested in a particular subject area, and think that you and others could benefit from some study in that area, write Jim McGee, assistant dean of continuing education, at P. O. Box 2727, East Carolina University in Greenville to express you interest. Sumner Midgett of Camden and Hughes Tillett of Wanchese are also good sources of information on what is in the works for fishermen.

As part of their efforts to help fishermen, Sea Grant agents can direct you to financial and technical assistance available from federal and state agencies. They are also eager to put you in contact with people who can assist with marketing, quality control or other problems you face.

-Help at the other end of the line:

The East Carolina University Marine Advisory Service will accept collect calls from North Carolina fishermen in need of assistance. Calls can be made to Jim McGee in Greenville at 758-6138, Hughes Tillett in Wanchese at 473-3937 and Sumner Midgett in Camden at 336-4790.

-Gear and handling problems:

Norm Angel, Art Chleborowicz, Walter Jones and Gene Crow can be reached in New Bern to help with gear, equipment and handling problems. For instance, if you're interested in insulating your boat, trying twin-trawling shrimping or eel fishing, Angel and his staff can provide you with information they have gathered in their own tests and from trials in other states. They can be reached by writing the N. C. State University Industrial Extension Service, P. O. Box 1125, New Bern or by calling 637-5255.

Places and people every angler should know

-Information Centers:

A library on wheels stocked with information on a wide range of topics of interest to the fishing community travels the roads of northeastern North Carolina, Sumner Midgett of Camden drives the mobile library. As of now, it follows no regular route or schedule, but Midgett will answer requests for information.

The Seafood Laboratory at Morehead City, jointly supported by Sea Grant and the NCSU Department of Food Science, features an information center. There, fishermen and anyone else interested in seafood can gather facts and figures on topics ranging from boat repair and safety to processing.

-Folks with facts:

Dr. Frank Thomas, extension professor of food science at N.C. State University, and Ted Miller. director at the Seafood Lab in Morehead City, work closely with the fishing industry. Although their work, supported jointly by Sea Grant and the N.C. Department of Natural and Economic Resources. Agricultural Extension Service, focuses mainly on processing and improving fish products, they are interested in helping fishermen bring in a catch of high quality which will bring a better price. Miller are the Division of Marine Fisheries and the Seacan be reached by writing to the Seafood Lab, P.O. food Industries Section of the Division of Com-Box 51, Morehead City or by calling 326-4901. merce and Industry. Thomas is at 129-F Schaub Hall, N. C. State University, Raleigh. His phone number is 737-2956.

N.C. AGRICULTURAL EXTENSION SERVICE

-A fisheries economics specialist:

In the past, information on fishing-figures on landings, costs and returns-in North Carolina has been lacking. Jim Easley, an extension specialist, is working to build up information on North Carolina's fishing industry. Data, when compiled and put into usable form, will be of use to counties in land-use planning and to individuals to the costs of fishing with diesel fuel and in interested in the costs and returns of fishing. Fishermen may be interested in studies now underway to compare the costs of fishing with gasoline to the costs of fishing with diesel fuel and with similar studies to determine what size boat yields the best returns. Easley can be reached at 3108-A

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Library, N.C. State University, Raleigh or by calling 737-2472.

-Help at home

County extension agents, headquartered in all of the state's 100 counties, know where to call and who to see for assistance with commercial fishing problems. The phone number of your county extension agent may be found in your telephone directory under your county's Agricultural Extension Service listing.

STATE AGENCIES SERVING FISHERMEN

Agencies in the N.C. Department of Natural and Economic Resources are working to benefit the state's fishing industry. Much of their work is aimed at protecting fishery resources for future generations and at building an industry that will continue to prosper for years to come.

Dr. Arthur Cooper, assistant secretary of the holds major responsibility for administering the state's marine-related activities.

Agencies responsible for fisheries and seafood

—Division of Marine Fisheries:

The mission of the Division of Marine Fisheries is to manage the state's coastal recreation and commercial fisheries. The agency's goal is to encourage fishermen to make the best use of resources today without over using or depleting stocks for tomorrow.

To carry out their management mission, the agency sponsors a double-pronged program of research and enforcement. Research is aimed at learning more about North Carolina's fishery resources. An ongoing inventory of estuarine areas is designed to determine what fisheries we have, where nursery areas are located and when shrimp and fish occur in greatest numbers. Other research centers around shrimp-its growth, populations and best size for harvesting. Further development of offshore fisheries, including such species as squid and scallops, is also part of the agency's work.

Research results, as well as information obtained from fishermen, help the agency define fishing regulations. Marine Fisheries is responsible for enforcing fishing regulations and for setting season opening dates.

The agency's control of dredge and fill activities in estuarine areas is of significant benefit to the fishing industry. By regulating the dredging and

State services continued

filling of marsh areas, Marine Fisheries is slowing the loss of marsh, an area vital to the growth of many fishery species.

Agency officials, headquartered at the Department of Natural and Economic Resources laboratory in Morehead City, are available to assist fishermen with questions. Questions about dredge and fill regulations may be directed to James T. Brown. Walter Godwin is in charge of research and development and James Tew is chief of law enforcement. Ed McCov, commissioner of Marine Fisheries, is also eager to help. All may be reached at the Morehead City NER lab or by calling 726-

-Seafood Industries Section

The Seafood Industries Development Program works to encourage the expansion of seafood and marine-related industries in North Carolina. Alvah Ward, program coordinator, believes that Linton heads the office which is located at 410 expansion and development of all links in the seafood marketing chain-from fisherman to consumer—benefit the entire industry. The Program seeks to improve the movement of seafood through and use of marine resources can aid in preserving trade channels and to heighten consumer interest in seafood. Results of the Program point to more jobs for coastal residents and a healthier seafood industry.

The Seafood Industries Section consists of three parts. Ward, who is a seafood industries consultant, seeks to encourage investors to put their money in the Tarheel seafood industry. His efforts center around encouraging financial institutions to understand and take a second look at the seafood industry as a good investment. He is also involved in assisting those already in business to continue and expand.

Paul Allsbrook, a seafood marketing specialist, heads the second part of the Seafood Industries Section. Allsbrook works between seafood wholesalers and retailers. He provides processors and other seafood suppliers with information that may help them sell their products to retail food stores. Allsbrook consults with processors on the forms and quantities of seafood that make the best sellers in retail markets and on shipping arrangements.

Fay McCotter, seafood home economist, works with food editors and home economists to create at developing eel aquaculture techniques in North shopper interest in seafood. Her job is to get information to the consumer on the availability of seafood supplies and to help the homemaker make the best use of fish products by introducing her mation on a wide range of coastal and marineto new ways to prepare them.

Ward, Allsbrook and Ms. McCotter are at 112 W. Lane Street in Raleigh and may be reached by phone at 829-3760.

The Seafood Industries Program occasionally

conducts short-term projects to alleviate severe marketing problems in the seafood industry. In August when the state's shrimpers found shrimp supplies up and prices down, the Seafood Industries Program mounted a campaign to urge consumers to buy shrimp. The program succeeded in increasing demand, lowering supplies and spur-

A group of fisheries development representatives, a part of the Seafood Industries Section, are conducting preliminary studies to learn more about landings and dockside prices and to determine more accurately where fish are caught and with what type of gear. The work of the representatives should provide information useful to fishermen in making decisions on what to fish for, with what and where.

-Office of Marine Affairs:

The Office of Marine Affairs, a division of the N.C. Department of Administration, is designed to coordinate all state marine activities. Dr. Thomas Oberlin Road, Raleigh. Marine Affairs is heavily involved in putting the recently-enacted Coastal Area Management Act into action. Wise planning fishery resources.

-N.C. Division of Health Services:

The Division of Health Services is another state agency concerned with a healthy seafood industry. Inspection and declaration of waters unsuitable for oystering is one example of their services to the industry.

-Coastal Plains Regional Commission:

The Coastal Plains Regional Commission (CPRC), is an agency designed to help spur the economies of coastal areas in North and South Carolina and Georgia. With funds from state and federal sources, CPRC provides cooperative support to research and development, as well as to advisory services, in coastal areas. One cooperative venture by CPRC and Sea Grant has been aimed

The Coastal Plains Center for Development Services in Wilmington is a storehouse of inforrelated subjects. Information and services at the Center are available to anyone interested in coastal development. The Center is located at 1518 Harbour Drive, Wilmington and is directed by Beverly C. Snow Jr.

Fishermen look to co-op

(Continued from page 1)

interview. And as the John Duke chugged by a dozen other boats, Capt. Tillett's face showed disgust at the price he was getting for shrimp-about half as much as at the same time last year.

Low prices and soaring expenses threatened to sink some shrimpers. Capt. Joe McGowan of Engelhard spent all winter making a 104 foot long Navy rescue boat into a trawler named the Rendezvous. But after only a few weeks of shrimping, Capt. McGowan couldn't clear enough to keep his thirsty two-engine Rendezvous running. All he could do was pay the \$15 per day fee to store his boat and wait for the price of shrimp to rise.

Shrimpers disagreed with reports that 1974 marked a bumper year for the shrimp crop. "We're only catching a handful more than we did last year." Capt. Tillett said. "Soon as we came out at the end of July, there were alot of shrimp. But after about two weeks into the season, the catch dropped back to about normal," the skipper said.

A variety of reasons were given for the sudden drop from last year's banner shrimp prices. Among them were a market glutted with this year's bumper crop which hit while freezers remained full of last year's catch and the small size of the shrimp in this year's landings.

Carolina University, many shrimpers were being to see who can flip off shrimp heads the fastest. forced to use all their income just to meet day-toback to zero," he said.

to pay. But Capt. Tillett and about 200 other north- and stored in a large freezer. eastern North Carolina commercial fishermen sion, the fishermen organized a cooperative.

men's Association, as the cooperative is called, a fisherman can pool his money with that of others to buy nets, fuels and other supplies at cheaper bulk and Wanchese, a collecting point for finfish. rates. More importantly, the association is trying to help fishermen become their own dealers.

wholesale market:

Craig, 13, and deckhand, Richard Scarborough, place. 19, dump nets bulging with shrimp, fish and crabs

There, the fishermen's association owns a hand- known for a lifetime.



Capt. Moon Tillett (left) of Wanchese saw the price of shrimp plunge to 1948 levels this year. At the same time, costs for fuel, food and other essentials had doubled from last year, leaving he and hundreds of other fishermen caught in a severe costprice squeeze, His son, Craig, 13 (right) is a member of his father's crew. Craig intends to follow in Dad's footsteps and be a fisherman too.

Low prices and high costs caught many shrimp- ling plant for shrimp which is managed by ers in a cost-price squeeze that may hurt more in Charles Equils, Capt. Tillett's shrimp are unloaded the future than today. According to James A. onto the dock and dumped onto a large table where McGee, UNC Sea Grant advisory agent from East women and young people crowd around, racing

Headed shrimp are dumped into a vat of water day expenses. "Once a vessel wears out, they're for washing. A conveyor belt carries the shrimp into the next room where a machine sends them For this season, many of the shrimpers had to down a chute, separating the shrimp by size. Next settle for what marketplace dealers were willing they are packed in ice in 50 pound cardboard boxes

The shrimp brought into Engelhard are sold by have taken action they hope will mean bigger telephone and shipped away—to markets in North profits in the future. With help from the UNC Sea Carolina and points north. Each box is labeled Grant Program, the N.C. Rural Development with the name of the shrimper who caught its con-Fund and the Coastal Plains Regional Commis- tents. When sales are made, the association keeps a small percentage of the sale for handling. The By being a member of the Sound and Sea Fisher-fisherman who caught the shrimp gets the rest.

The Sound and Sea Fishermen's Association also leases handling plants in Hatteras, Ocracoke

Before the Association was formed, individual fishermen were forced to take what dealers offered. Here is an example of how the Association hopes There was no way they could both catch and market to help members sell their catch directly to the their catch. Members believe that once the Association has some marketing experience, they will, Capt. Tillett and his sons, Billy Carl, 23, and at least, be able to call a few shots in the market-

But no matter how the market treats him, if he's onto deck, sort the shrimp and bring their catch to able, you can bet that Capt. Tillett will be out there somewhere in the Sound, studying the horizon he's

You should know . . .

New oil dumping regulations, effective July 1.

The Federal Water Pollution Control Act prohibits the discharge of oil or oily waste into or upon U.S. navigable waters. Violators are subject to a \$5,000 fine.

Under the regulations, vessels of less than 100 gross tons are required to devise some fixed or portable means of discharging any oily bilge slops or oily ballast to a shoreside receptacle.

Effective July 1, 1974, all owners of U.S. vessels 26 feet or longer must place a placard in the vessel's machinery spaces or at the bilge and ballast control station which states:

DISCHARGE OF OIL PROHIBITED

The Federal Water Pollution Act prohibits the discharge of oil or oily waste into or upon the navigable waters and contiguous zone of the United States if such discharge causes a film or sheen upon, or discoloration of, the surface of the water, or causes a sludge or emulsion beneath the surface of the water. Violators are subject to a penalty of \$5,000.

Commercial fishermen may obtain copies of the placard from: National Marine Fisheries Service, Div. of Extension, P. O. Box 1246, Gloucester, Ma. 01930.

Inspection Urged

The U.S. Coast Guard, in cooperation with the Broadwater Boat Company, Mayo, Md., has issued a warning to owners of wooden 25, 27, 29 and 31 foot Broadwater boats. The warning urges owners to inspect the hulls of their boats for cracking, bulges, hollows, loose screws or layers of wood coming apart approximately nine feet below the bow or at the location of the forward support when the boat is cradled for winter storage and maintenance.

Owners of Broadwater boats who detect indications of damage are urged to contact Broadwater boats and the Coast Guard with a description of the damage and the location of the boat or where it may be inspected.

Vessel Financing

Details pertaining to revised fishing vessel financing regulations recently announced by the National Oceanic and Atmospheric Administration were published in the Federal Register on May 17. Further information, of potential interest to those working in the fishing industry and those who finance fishing vessels, can be obtained from the Financial Assistance Division, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Washington, D. C. 20235.

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University of North Carolina Sea Grant Program NEWSLETTER

NOVEMBER, 1974

1235 Burlington Laboratories NCSU, Raleigh, N. C. 27607 Tel: (919) 737-2454

Getting set to farm the oceans

Imagine producing 20,000 pounds of meat in one acre in a single year. Some farmers in the southeastern part of the United States average that. But they aren't your typical farmer. Their crop is catfish. And their method is aquaculture, loosely defined as fish farming.

In spite of success in catfish farming, the culture of fish, shellfish and other organisms that live in coastal or ocean waters is plagued with problems and a general lack of knowledge. Even though aquaculture is centuries old in some parts of the world, it is an art that remains riddled with questions. Yet, in a world hungering for animal protein, the development of marine aquaculture, or mariculture, could make substantial strides toward bolstering protein supplies.

Sea Grant is one of many government and private organizations across the nation working to make farming the sea profitable. Studies are underway to determine the specific nutritional and environmental needs of different types of organisms as they grow from egg to adult. Scientists are also seeking to develop through cross breeding fish and shellfish that grow fast and big without too much trouble.

North Carolina's coastal waters are still teeming with shrimp, crab and good-tasting fish. Looking to the future when these organisms may become scarce and demand will be greater, UNC Sea Grant scientists are grappling with two of aquaculture's basic problems—techniques for rearing various species under controlled conditions and disease.



Finding ways to grow the dolphin fish

It's no secret that aquaculture, compared to its sophisticated sister, agriculture, lags behind. A century ago, scientists began determining the best soils, fertilizers, environmental conditions and planting techniques for growing corn and other crops. Before aquaculture can be successful, researchers must determine environmental and nutritional requirements for rearing fish and shell-fish in enclosed tanks and ponds.

UNC Sea Grant has supported research aimed at learning what conditions are crucial to successful fish culture. Studies have focused on the dolphin fish, a fish not to be mistaken for the porpoise, and the American eel, a delicacy on European and Asian tables with export potential.

For years, anglers have hauled in dolphin off North Carolina's coast. And even though folks in Hawaii refer to dolphin as mahi mahi and consider it a delicacy, demand for the fish has been small elsewhere. Fishing for dolphin has generally not been economically worthwhile.

(See "Dolphin," page 4)

Panel hears Sea Grant plans for '75 projects

The UNC Sea Grant Program underwent its annual review Oct. 2 and 3 at East Carolina University. Some 25 research, education and advisory services projects proposed for 1975 were presented to an eight member committee for review and recommendations.

The review team, selected by the Office of Sea Grant in Washington, D. C., included representatives of government, university and business. Members of the review panel were Dr. Sanford S. Atwood, president of Emory University; Arthur Alexiou, director of Institutional Support Programs of the Office of Sea Grant; Kenneth Hong, Office of Programs and Budget of the National Oceanic and Atmospheric Administration: former North Carolina congressman Alton A. Lennon, Wilmington attorney; Walter J. Gray, director of the New England Marine Resources Information Program; Dr. Theodore R. Rice, director of the Atlantic Estuarine Fisheries Center in Beaufort; David Duane, Institutional Support Program of the Office of Sea Grant; and William C. Brewer, general counsel for NOAA.

Remarks by Dr. Arthur W. Cooper, assistant secretary of the N. C. Department of Natural and Economic Resources, Dr. E. Walton Jones, associate vice-president of the University of North Carolina, and Dr. Robert L. Holt, East Carolina University vice-chancellor, opened the meeting.

Bruce A. Lentz, secretary of the N. C. Department of Administration, concluded Wednesday's presentations with comments on the state's interest in the Sea Grant Program.

Sea Grant is supported by funds from the N. C. Department of Administration and the U. S. Department of Commerce's National Oceanic and Atmospheric Administration.

After a morning session of review with program administrators, the review panel flew to Manteo to meet with members of the Sound and Sea Fishermen's Association at the cooperative's handling plant in Wanchese. After a lunch of boiled shrimp and steamed crab, the committee got a bird's-eye view of the state's Outer Banks from the air as they flew to Beaufort. There they toured Charles Davis' menhaden and fish processing plants.

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Research on how to grow eels to fill export demands are underway in North Carolina.

Tarheel eels raised for foreign markets

Eel isn't one of those foods that Americans clamor for at their favorite restaurants. But in Europe and Japan, already high demand for the slippery creature is growing.

North Carolina's coastal waters serve as home for the American eel during a major part of its life. With world demand increasing and local eel supplies abundant, the possibility of exporting eels from coastal North Carolina appears promising. One way to meet the long-term demand on a regular basis is to grow eels in tanks and ponds and export them after they are grown.

Already eel export has become a thriving business in eastern North Carolina. Exports from this state are estimated to have jumped from 70,000 pounds in 1972 to 500,000 pounds in 1973.

Norman B. Angel, Sea Grant advisory services specialist and industrial extension agent, has devoted much of the past year to exploring the potential of eel culture in eastern North Carolina and marketing eels in Europe and Asia. He has been assisted by Walter B. Jones. Support for the eel research was granted by the Coastal Plains Regional Commission, Sea Grant and the NCSU Industrial Extension Service.

Specifically the researchers investigated the feasibility of growing young wild eels captured in North Carolina waters to marketable size under controlled conditions.

Their study encompassed all aspects of eel culture, including capturing and handling young eels, or elvers, picking the site for a culture operation and constructing tanks and ponds, diet and disease control.

The researchers' findings and recommendations have been published in a report, "Aquaculture of the American Eel." It is available from Angel at P. O. Box 1125, New Bern, N. C. 28560.

Working the 'bugs' out of fish farming

Disease has been cited as the greatest single technical obstacle to aquaculture. Once a disease infests a tank or pond where organisms of the same species are crowded, the disease can spread with lightning speed. In no time, the entire aquaculture

population can be wiped out.

Dr. Charles Bland, associate professor of biology at East Carolina University, has focused his research on the disease organism, Lagenidium callinectes, a fungus that attacks blue crab, shrimp and other marine crustacea. Blue crab, common in North Carolina waters today, is considered a likely candidate for future aquaculture. When Bland began his research five years ago under Sea Grant support, he set out to learn how widespread the fungus is in North Carolina and how destructive it could be in aquaculture situations. Since then, he has shifted his emphasis to finding ways to control parasites of crabs and shrimp.

Bland's findings have enabled him to assist crustacean aquaculture projects across the nation. He has worked with researchers in Texas, Oregon, California, South and North Carolina on fungal diseases of shrimp, Dungeness crab, lobster,

Macrobrachium shrimp and eel.

In October, Bland traveled to Japan upon the invitation of the aquaculture panel of the U. S.-Japan Natural Resources Program to present his findings at a symposium on "Diseases of Cultured Organisms."

Before he could begin searching for ways to slow the fungus, Bland had to get to know more about Lagenidium—where and in what numbers it occurs and what happens to it through its life stages. The fungus, which attacks the egg mass, or sponge, of the blue crab, was found to occur in 95 per cent of the sponges examined before June 1. By August, Bland found that the infection rate had dropped to around 30 per cent, with no infected crabs being collected after July 9. Infection rate data over several years will be compared to such environmental factors as salinity, water termperature, and oxygen level to determine which factors contribute to increased rates of infection.

Bland and graduate student Don Ruch have tested a wide variety of chemicals to determine which can best control the development and spread of the fungus. Small doses of malochite green have

proven effective.

The next step in the research, which is now underway, is to determine what ill effects control chemicals may have on the development of crabs and shrimp. Bland's goal is to come up with a chemical that controls the disease without harming the crustacean.

One exciting development has been Bland's discovery that crab eggs may contain a substance



that effectively resists the fungus. He has learned that an extract from the eggs will cause a resistant cover to form about the spores (the infecting agent) of Lagenidium. Once enclosed, the spores quickly germinate, or begin to develop. But in the absence of a suitable host, they die shortly. After the substance is isolated, tests will be conducted to determine whether pre-treatment of water where shrimp and crab will be grown could stop the infection.

In another phase of his research, Bland has learned that shrimp are highly susceptible to infection by the fungus, *Haliphthoros*, in confined conditions. Attacking the gills and eyes of shrimp, the fungus is the same as that found causing disease in lobsters in California.

Aquaculture studies in nearby states

Sea Grant programs in neighboring South Carolina and Virginia are studying improved aquaculture of other species. In South Carolina, Sea Grant-supported researchers are devoting much attention to the culture of Macrobrachium shrimp, looking to the possibility of rearing them in South Carolina's abandoned rice fields. Macrobrachium is a big animal, with some species reaching up to nine inches in length. It has been described as being more like a lobster than a brown or white shrimp.

South Carolina researchers are also studying cultch-free seed oysters from the Wando River. Ultimately, they aim to develop guidelines for successful oyster cultivation in South Carolina.

Scientists at the Virginia Institute of Marine Science are working to develop superior cysters for mariculture, to identify conditions necessary for increasing the commercial production of the soft stage of the blue crab and determining the potential for commercial use of the rock crab. VIMS researchers with Sea Grant funding are also investigating the feasibility of culturing the hard clam and bay scallop.

Dolphin fish studied

(Continued from page 1)

But with an ear turned to the clamor for more and different kinds of protein, Dr. W. W. Hassler, North Carolina State University professor of zoology, has spent much of the past four years studying ways to grow the dolphin in captivity.

Determining conditions ideal for growth requires a detailed understanding of the life style, habitat and behavior of the fish. Early work by Hassler revolved around designing underwater pens for the fast-swimming dolphin and determining ideal water temperatures, salinity, lighting, oxygen requirements and diet.

Dolphin grow rapidly in nature. Scientists at Florida's Marineland have shown that well-fed dolphin can grow even faster in captivity. In less than eight months, they grew two dolphin from one and one-half pounds to 32 and 37 pounds. In similar work, Hassler and his associates have grown dolphin in pens at the NCSU's Hatteras Marine Laboratory with average weekly weight gains of .86 pounds.

More recent research has centered on rearing dolphin through the delicate egg and larval stages. Part of the secret to successfully growing dolphin is getting the fish to eat after the three-day-old yolk sac stage when it must begin to feed. Hassler and his research associates have successfully reared dolphin eggs caught in the field through that stage to 35 days at the National Marine Fisheries Laboratory in Miami and have hatched and reared dolphin eggs and larvae to 85 days at Hatteras.

Techniques for dolphin culture have progressed to the point where dolphin farming could become a viable industry.

Recently Hassler's aquaculture studies have included the culture of cobia. He has successfully hatched and reared cobia from egg to three and one-half months under controlled conditions.

University of North Carolina Sea Grant Program 1235 Burlington Laboratories North Carolina State University Raleigh, N. C. 27607



Conference surveys marine fisheries

North Carolina's in-shore and off-shore waters harbor a significant fisheries resource. But information on the state's marine fisheries, vital to industrial development of the fisheries industry, is needed.

That was a conclusion reached at a twoday conference on the status of the state's marine fisheries resources held in New Bern in mid-September. The conference brought together representatives of the fishing industry, state and federal agencies and university programs associated with marine resources.

Information on fishery resources is needed for planning, for monitoring the capital investment in the industry and for predicting the availability of raw materials and its impact on the industry, William H. Stevenson of the National Marine Fisheries Service said in summing up the conference. Current information is adequate for the first stages of planning, he said. But it needs to be organized and structured to be useful to potential investors.

"It appears to me that the fishing industry in North Carolina does have a positive future, does have an opportunity to create a viable continuing economic environment in the coastal area in North Carolina," Stevenson concluded.

The conference was the first of its kind in North Carolina to deal specifically with marine fisheries and their potential usage. It was sponsored by the NCSU Agricultural Extension Service, the N. C. Department of Natural and Economic Resources and the National Marine Fisheries Service.

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University of North Carolina Sea Grant Program

NEWSLETTER

DECEMBER, 1974

1235 Burlington Laboratories NCSU, Raleigh, N. C. 27607 Tel: (919) 737-2454

Carteret women test new seafood uses at Morehead City lab.



Cutting down on wasted seafoods

Mrs. Elmore Lawton was up to her elbows in a vat of slimy clams. Through rows of glass beakers and bottles of chemicals, she could see Mrs. Elsie Farlee across the room scrubbing clam shells. In the far corner, Mrs. Frances Turbyfill flipped shrimp toasties in and out of a frying pan.

Mrs. Lawton, Mrs. Farlee, Mrs. Turbyfill and the nine other women in the room weren't competing in a seafood cooking contest. In fact, they seemed to be more than at home working on the black-topped lab counters and dodging the scientific equipment at the Seafood Laboratory in Morehead City, a lab jointly supported by UNC Sea Grant and the North Carolina State University Department of Food Science.

Some of the women have been part of this setting once each month for almost two years. Called the Nutrition Leaders Advisory Committee, the dozen Carteret County women are contributing a special brand of expertise to seafood research. Each month they pitch in to help seafood scientists grapple with a number one problem: Reducing the waste of fish.

It's no secret. A lot of meat—protein that could be feeding hungry people today—is lost by commercial and sport fishermen. Com-

(See "Carteret," Page 3)

Albacore: From trash fish to tasty salad

Folks have seen it happen for too long-this waste of good seafood. And some are so fed up that they've begun making better use of their catch right at home. At least one New Bern family found that a little imagination can save a lot of fish.

In a letter to the UNC Sea Grant Program, C. H. Hall, vice president and general manager of Seashore Transportation Co., New Bern, writes of how his family has put albacore to use. Albacore is a fish landed by the hundreds on party boats that often goes back overboard because of its dark flesh, Hall says.

"But on one off-shore trip some years ago, my 'Yankee' wife went along and asked why I was wasting tuna. She kept an albacore, cubed it, parboiled it in a couple of water changes and made a salad that put 'chicken of the sea' to shame," Hall writes. He adds that his family no longer wastes albacore.

The Halls' experience is just one example of how far a little imagination can go toward reducing the waste of tasty, nutritious seafood.

Holiday party treats with a seafood flavor

The following recipes are favorites among members of the Nutrition Leaders Advisory Committee. As holiday party foods they offer an unusual treat—a touch of seafood flavor.

SHRIMP TOASTIES

8 oz. shrimp (slit each lengthwise and chop fine)

4 water chestnuts (finely minced)

1 egg, slightly beaten

6 slices of 2-day-old bread

1 teaspoon salt

½ teaspoon sugar

1 teaspoon dry sherry

1 tablespoon cornstarch

2 cups vegetable oil

Mix chopped shrimp with chestnuts. Add salt, sugar, cornstarch, beaten egg and sherry. Mix Trim crust from bread and cut each slice into 4 triangles. Spread 1 teaspoon shrimp mixture on each triangle.

In an electric frypan heat oil to 375°. Drop in 4 to 6 triangles, shrimp side down. (If mixture is of right consistency, it will stick to bread). When edges begin to turn brown (about a minute), turn and cook 5 more seconds. Remove from pan and drain. Keep warm in very low oven until ready to serve. These may be frozen. When ready to use, heat for 10 to 12 minutes at 400°. Makes 24 toasties.

HOBO CLAM DIP

18-oz. pkg. cream cheese

1 c. sour cream

2 teaspoons Worcestershire sauce

3 dashed hot pepper sauce

1 small green onion minced with top

1/4 teaspoon celery seed 2 radishes chopped fine 17½-oz. can minced clams

salt to taste

Whip cheese and cream until fluffy. Blend in drained clams and other ingredients. Season to taste. Chill thoroughly before serving. Makes around 21/2 cups.

STUFFED CLAM

2 c. toasted bread crumbs (prepared from sliced white bread toasted dark)

3 tablespoons mayonnaise

2 tablespoons Worcestershire sauce

1 small onion, grated

juice of 1/2 fresh lemon with scraping of rind

1/4 lb. oleomargarine, melted

1/2 teaspoon parsley

pepper to taste

paprika

40 oz. canned minced clams, drained (reserve liquid) or 1 qt. shucked quohogs, minced

20 hard clam shells-about 4" in diameter

Wash and boil 20 hard clam shells. Toast bread and place in blender until ground fine. In large bowl, mix first 9 ingredients. Add quohogs or canned clams to mixture. Use liquid drained from clams to adjust consistency to that similar to bread dough.

Stuff mixture into cleaned, boiled hard clam shells. Sprinkle with paprika. Bake at 350° for 25-30 minutes or until slightly brown on top. Serves 7-8 people. To freeze, cook until bubbly at 400°. Freeze. When ready to serve, heat at 400° til bubbly and brown.

Carteret County women bring expertise to lab

(Continued from page 1)

mercial anglers often can't sell unusual species like albacore and grunt that they catch along with the fish they put their nets out to land. Frequently, the fish that folks don't commonly eat is just thrown back. Sport fishermen sometimes aren't sure how best to handle and prepare the trophies they haul in, It too often goes to waste.

The Nutrition Leaders are convinced that their

efforts at the lab will help reduce waste.

"We're trying to find recipes to show you can use fish and fish parts not considered edible before," said Mrs. Turbyfill as she plopped a shrimp toasty on a paper towel to cool. "We've made recipes with bonito, squid and other fish not now for sale to help begin developing a market for these," she added.

"We're finding new uses for seafood and making it attractive and appetizing," Mrs. Farlee said, adding that the group is looking for economical

and practical ways to use seafood.

According to Ted Miller, director of the lab, the nutrition leaders are more than "good cooks." While they do bring handy skills and a history of food preparation with them, a major contribution is the information they provide on what North Carolinians like and dislike in seafoods. In judging the recipes they concoct, the women give scientists valuable insight into the flavors, textures and aromas that North Carolinians prefer in fish and seafood products.

Their work is but one part of an overall effort by Sea Grant to encourage better handling and use of ocean and coastal fisheries. Sea Grant advisory agents and researchers are concerned with improving seafood handling and processing from the moment it lands on the deck until it is frozen, thawed and cooked. Another more technical phase of seafood research supported by Sea Grant is being conducted at NCSU's Department of Food Science. There scientists are learning more about the nutritional, chemical and physical characteristics of seafood as it is treated in different ways.

Much of the Nutrition Leaders' work is aimed at finding ways to use "trash" fish, fish that haven't caught on as popular seafoods. Squid, bonito, grouper and dolphin are a few of the species they have worked with. Also, the women have used fish tissue separated from tiny bones by a magical

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The Nutrition Leaders spend one morning each month concocting recipes that call for fish that folks are familiar with—and for fish they may find unusual.

deboning machine to stretch or even replace other seafoods, beef and pork. The deboned fish tissue is similar in texture to other ground meats. They've also looked for ways to use fish heads and bones as flavor enhancers.

Using the deboned tissue, the Carteret County women have replaced from one-half to all of the crab in crab imperial with deboned tilefish. They've used deboned menhaden to make stuffed clams and have even mixed it with ground beef to make hamburgers. In other recipes spot has replaced more than half of the pork in pork sausage, ravioli, won ton and egg rolls.

The Nutrition Leaders and seafood scientists hope their work will encourage fish markets to begin selling deboned fish for use at home, in school and hospital food programs and at

restaurants.

Through their monthly visits to the lab, the women are helping Sea Grant researchers keep in tune with the needs and preferences of coastal Carolinians. And through presentations to the home extension clubs they represent, the Nutrition Leaders are taking information developed in laboratories to the people who can put it to use.

All about Sea Grant

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Putting fish pizza to the ultimate test

You don't just come up with a new product without trying it out on the people who might later use it.

That's why researchers at the Seafood Lab took their experiment with fish-topped pizza to the Camp Mitchell 4-H Camp in Swansboro this summer. There they tested their recipe on some of the world's most enthusiastic pizza eaters—boys and girls, ages 9 to 13, from central and coastal North. Carolina.

In a brief survey of the campers, pizza won easily as the number one main dish favorite of both Onslow and Alamance County children. Hamburger also ranked near the top. Fish, fish sandwiches and hotdogs got a clear thumbs-down as main dish foods.

To find out how the new pizza which was topped with a mixture of deboned fish and hamburger, compared with hamburger pizza, campers ate samples of both and rated them. When ratings came in, researchers found that their experimental pizza had won few, if any, friends. On a scale of 3, campers rated the beef pizza at 1.9 and gave the fish pizza a rating of only 1.4.

Both pizzas suffered because they had to be reheated before serving, researchers say. The fish pizza, they believe, would have ranked higher had the staff not deliberately used spot, a strong-flavored fish, to find out how children would react to something easily identified as fish.

Not discouraged, the seafood lab staff has continued work on a combination fish-hamburger pizza and believe they have now come up with a recipe that will delight pizza eaters of all ages. According to Linda Burgess, lab technician, the fishy flavor is largely erased in the new recipe.

Ted Miller, lab director, points out that the fishhamburger pizza could eventually be put to use in school and hospital food programs as a nutritious and economical main dish. This could lead to businesses handling and selling deboned fish and fish products, he adds.

University of North Carolina Sea Grant Program 1235 Burlington Laboratories North Carolina State University Raleigh, N. C. 27607



Local land planning guidelines reviewed

Coastal and state government officials met in three workshops during November to iron out questions relating to local planning guidelines proposed by the state. Under the Coastal Area Management Act, the state is to prepare broad guidelines for use by local governments in developing land-use plans.

The workshops, held in Wrightsville Beach, New Bern and Elizabeth City, provided a forum for reviewing and commenting on tentative planning guidelines set forth by the state. UNC Sea Grant and the Institute of Government co-sponsored the workshops.

Suggestions for changes in the guidelines presented at the workshops are being compiled and relayed to the Coastal Resources Commission, the agency which will finally approve the guidelines.

Panel members at the workshops included Milton Heath and Philip Green, Institute of Government; Roy Paul, State Planning Office; and Mark Sullivan, Department of Natural and Economic Resources. Members of the Coastal Resources Commission and representatives of DNER regional and local organizations also participated.

The workshops were aimed at informing professional planners for city, county and regional planning agencies, city and county managers, planning board members and local government officials on the guidelines. Feedback from these groups heard at the workshops will go into the final guidelines.

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University of North Carolina Sea Grant Program

NEWSLETTER

JANUARY, 1975

1235 Burlington Laboratories NCSU, Raleigh, N. C. 27607 Tel; (919) 737-2454



Winter fishing

A game of wait-and-see

Trawlers jam Wanchese harbor while Tarheel fishermen wait for calmer winds.



Capt. Daniels

An ear to the weather report, an eve to the sky

Capt. Charles Daniels didn't look one bit worried. He wasn't pacing up and down the dock or checking his watch or even looking nervously toward the ocean. In fact, he seemed more than glad just to sit back and talk about everything from football to women's liberation.

In similar situations, other men would have hurled a curse or two and planted a scowl across their brow.

The sun had barely peeped over the horizon and already plans he'd made just the day before had to be ditched. Capt. Charles had gotten up early, eager to crank up his trusty vessel, the Mitzi Kay, and nose her out of Wanchese for a three hour trip to the Atlantic's flounder fishing grounds.

But by 8 o'clock that morning, Capt. Charles knew it would be another day of hanging around the dock, tinkering with his boat, chewing the fat with other captains—and just waiting.

It was the weather that changed his plans. The (See "Trawl," page 3)

What becomes of Tarheel fish between dock and dinner plate

Fish and seafood products lining freezer counters in North Carolina supermarkets may have been caught by Tarheel fishermen.

But chances are that before North Carolina-caught fish arrived at your

local grocery, they took a detour north.

Most seafood landed by North Carolina's commercial fishermen gets to the Tarheel consumer in a round-about way. Usually fishermen sell their catches to a dealer, with prices they receive depending on the quality of the fish, its current and predicted supply and demand.

Dealers sell most of their fish by phone and ship it by truck out of the state to markets in New York, Baltimore, Philadelphia and the Hampton

Roads area. These markets become further distribution points.

Processors are among the biggest buyers from the fish markets. They prepare and package fish and shellfish, turning it into hundreds of different seafood products. Food wholesalers and retailers distribute seafood products to local supermarkets.

In the last few years, the long detour between the state's docks and its dinner plates has shortened as the number of Tarheel processors has grown. During 1973-74, 11 new seafood receiving and/or processing plants were built in the state. There were a dozen major plant expansions during the same period. Estimated total capital investment in both new and expanded plants was \$4.1 million. More than 400 new jobs were created.

Although data is not complete, estimates are that North Carolina plants now process 35 per cent of the state's total landings. That's up from an

estimated 15 per cent processed in-state in 1969.

"There's no question that there's room for further expansion of seafood processing and handling facilities in North Carolina," according to Alvah Ward, coordinator of the state's seafood industries development program, a division of the N. C. Department of Natural and Economic Resources. In addition to the need for more icing and sorting facilities, Ward stressed the need for "further processing," processing that moves into heading, gutting and filleting.

Processing plants don't need to be built on the waterfront, according to Dr. Frank Thomas, Sea Grant advisory services agent who works closely with the seafood processing industry. In view of some new Environmental Protection Agency regulations, it may be better not to build on the waterfront, he said. Several new processing plants were built inland, he added.

Although information is incomplete, Ward believes that more fresh fish is moving to North Carolina's inland than ever before. Much fresh fish makes its way into North and South Carolina coastal resort areas, he said. Fish caught in the central coastal area—from Sneads Ferry to Washington, N. C.—is more likely to move inland than that caught in the northeastern reaches of the state, he said. Most of that travels north, he added. Fish caught in the southern district is distributed northward and inland, according to Thomas.

A UNC Sea Grant research project which begins this month should shed more light on seafood marketing. Researchers Drs. Richard Summey and R. M. Piper of the East Carolina University School of Business are tracing the route seafood follows from fishermen to distributor and are trying to pinpoint problems in the marketing system. Information gained in this study promises to be useful to investors interested in seafood processing.

The Coastal Plains Regional Commission, an agency seeking to improve the economic well-being of coastal regions in the two Carolinas and Georgia, has named seafood marketing as a high priority problem area. A CPRC ad hoc committee is studying seafood marketing problems and is advising the governors of the three states on their findings.

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Wanchese could be distribution point

Much of the state's commercial catch goes north simply because there is no major distribution point in North Carolina. Currently dealers ship their purchases of Tarheel fish to large northern cities for distribution.

But looking to the future, a major distribution point in the state makes sense, especially with tougher processing pollution controls on the horizon, says Alvah Ward, seafood industries program coordinator.

Distribution would be a significant part of activities at the proposed Port of Wanchese, Ward said in an interview. The Advisory Budget Commission has approved and included in its recommendations to the 1975 General Assembly funds for capital improvements in the Wanchese Harbor Project, a development proposed by the state of North Carolina and the federal government.

The proposed harbor complex would provide basic facilities such as water, sewer and streets around which privately-owned seafood industries could be built. Improvement of Wanchese harbor and deepening and stabilization of Oregon Inlet are included in the proposed project.

"In addition to bringing fishers, processors and support industries together, such a facility would bring in a large volume of the product so it could move from one point," Ward said.

"Depending on the Environmental Protection Agency's stance on future pollution abatement system requirements, seafood companies may find that centralized disposal systems make good economic sense," Ward added.

A central facility could also encourage further investment in North Carolina's seafood industry, he said.

All about Sea Grant

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Billy Carl Tillett and Steve Daniels take advantage of a day in port to repair nets.

Trawl fishing: It's around-the-clock work

(Continued from page 1)

man on the radio had promised gusty winds for that December afternoon, winds that can make life on a 50 foot boat like the Mitzi Kay miserable and treacherous. But in 30 years of fishing, Capt. Charles had learned not to argue with the weather. Sometime along the way he came to the conclusion that all you can do about the weather is live with it—especially if you're winter fishing. Waiting for the weather to cooperate is just part of life for the men who make a living fishing from December into April.

In a village like Wanchese, winter's coming is signaled by more than a dip in temperature. Sometime in November, the men whose boats plied Pamlico Sound fishing for croaker, spot and shrimp last summer and fall grab an extra sweatshirt and get their boats ready to churn beyond the Outer Banks into the Atlantic.

For shrimpers, converting their vessels for "trawl fishing," as flounder fishing is called, requires replacing shrimping gear that reaches out from the sides of the boat with rigging off the back, or stern, of the boat. For those who "long net"—a type of summer fishing that uses three skiffs and as much as 2,000 yards of net—, the change to winter fishing means putting the three skiffs in mothballs and dusting off the boat used only for winter trawling. The Mitzi Kay, a vessel that has served several captains for almost half-century now, is used only for winter fishing.

When the weather does cooperate, North Carolina's commercial fishermen can be found between the "edge" of the continental shelf and the eastern shores of the Outer Banks.

Some believe trawling for flounder is the toughest kind of fishing. "The work itself isn't that

hard," said Hughes Tillet, Sea Grant advisory agent who fished out of Wanchese for 30 years. "It's the hours. They drag (nets) day and night. When they leave Wanchese, they don't cut off their motors until they get back," Tillett added, holding a match to his pipe. "Many of them leave on Monday and don't get in until Friday—and that's working around the clock," he said.

Steve Daniels, husky 21-year-old son of Capt. Charles, knows well the hours trawl fishermen work. Along with Robert Daniels, Steve and his dad are up and down around the clock, hauling in

"It's the hours. They drag night and day."

the Mitzi Kay's nets about every two hours. After the catch is on deck, the work of sorting out trash fish and stashing the flounder and other marketable fish in the ice hold begins.

With breezes whipping off the wintry Atlantic, work on the deck can be cold business. But according to Tillett, "when it's cold, a man's not going to be long getting them (the fish) in the hold."

Back inside the cabin, heat from the engine thaws frozen fingers and noses, until it's time to start over again, hauling in the nets and sorting.

On the dock in Wanchese, Capt. Charles was taking it easy. His plans to fish that December day had been changed—and he knew they would probably be changed many more times—by the weather. But that's kind of a way of life for him. Already he was looking forward to that evening's Christmas play practice at the church. Tomorrow, he would be up early again, ready to roll with whatever punches old man weather decided to deliver.

Outer Banks film available for loan

"Waterbound—Our Changing Outer Banks," a film about North Carolina's barrier islands, is

available for loan to groups.

An outgrowth of Sea Grant-supported research by East Carolina University geologists Drs. S. R. Riggs and M. P. O'Connor, the 16 mm, color film tells the story of the changing shape of the state's Outer Banks. It surveys the geologic processes which have and are continuing to act on the state's coastline. The film further outlines man's attempts to challenge these processes.

To borrow the film, write UNC Sea Grant Program, 1235 Burlington Laboratories, North Carolina State University, Raleigh, N. C. 27607. Requests for the film should be submitted at least two weeks prior to the viewing date and should include dates preferred for showing. Sea Grant asks that borrowers return the film in the same condition as it was received within three days of the showing and that return postage be paid.

Copies of the film may be purchased for \$83.38. Contact the UNC Sea Grant Program office for

further details.

Conference planned for marine fisheries staff

North Carolina marine fisheries personnel will be able to take advantage of a workshop on resource conservation in February.

Sponsored by the N. C. Department of Natural and Economic Resources, the short course will be held in Morehead City and Edenton. Sea Grant is cooperating in arranging the program.

During the two-day event, marine fisheries personnel will review and explore the purpose of environmental legislation relating to control of erosion and pollution, dredge and fill, dune pro-

tection and channelization.

An early afternoon session will survey problems related to the geology of the state's coast. Workshop participants will study the impact of storms, currents and obstructions on nearby shorelines.

In the late afternoon, the interaction and the role of other divisions in the Department of Natural and Economic Resources which are involved in solving marine fisheries will be reviewed.

The second day of the workshop will include an interpersonal communications course for fish-

eries enforcement officials.

Sea Grant agents whom you should know

Following is a list of Sea Grant agents who work closely with fishermen and the fishing industry. They are available for questions and assistance.

For help with fishing equipment, methods, handling and business management:

Jim McGee, assistant director of continuing education, East Carolina University, Greenville. Phone 758-6324.

Hughes Tillet, advisory agent head-quartered in Wanchese. Phone 473-3937.

Summer Midgett, advisory agent headquartered in Camden. Phone 336-4790.

For assistance in handling and processina:

Frank B. Thomas, extension food scientist, North Carolina State University, Raleigh. Phone 737-2956.

Ted Miller, director of seafood lab, More-

head City. Phone 726-7341.

University of North Carolina Sea Grant Program 1235 Burlington Laboratories North Carolina State University Raleigh, N. C. 27607



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N. C.



University of North Carolina Sea Grant Program

NEWSLETTER

FEBRUARY, 1975

1235 Burlington Laboratories NCSU, Raleigh, N. C. 27607 Tel: (919) 787-2454

New harbor could boost income and jobs

Artist's conception of proposed Wanchese harbor complex.

When most folks hear the name Wanchese, they probably think of an Indian chief. But if the 1975 N. C. General Assembly gives its stamp of approval, the name Wanchese could become better known as one of the nation's major fishing centers located in northeastern North Carolina.

A vote by legislators to initiate funding for a proposed harbor complex in the Dare County community of Wanchese could create new jobs and fatten pocketbooks in an area where unemployment is high and individual income is low compared to the rest of the state and nation. And with a show of support by the state, the federal government will carry out a project authorized by Congress in 1970 to deepen and stabilize Oregon Inlet and avenues connecting Wanchese with rich Atlantic fishing grounds.

Together, development of the proposed harbor complex and improved access to fishing areas could be the combination needed to boost the state's seafood industry.

Today Wanchese is a tiny community snuggled to the edge of southeastern Roanoke Island. Already it is a major port for many of the state's commercial fishermen. But the harbor at Wanchese and



the routes to and from the port are shallow and often treacherous even for smaller boats. During peak fishing season and bad weather when many boats dock there, the harbor is jammed with vessels from Texas to Maine.

Many local, state and federal officials and coastal citizens believe that with the proposed improvements, Wanchese, located near a gold mine of fishery resources, could become a major center for collecting, processing and distributing seafoods. The project is a top priority of the Holshouser administration and enjoys support of the state's U.S. congressional delegation as well as local and regional government and planning agencies.

Improvements proposed for the harbor and Oregon Inlet would be done in separate, coordinated state and federal projects. But in order for any of the work to be done, the state must first fund the harbor development phase of the project. Without financial commitment by the state, the federal government would probably be unable to justify the expense of its project which includes permanent stabilization of Oregon Inlet with jetties, especially in a time of budget cutbacks, according to Alvah

(See "A better," page 3)

UNC Sea Grant awarded funds to carry out 1975 projects

The federal Office of Sea Grant and the state of North Carolina have awarded more than \$800,000 to the University of North Carolina Sea Grant Program for the support of marine and coastal research, education and advisory activities during 1975.

A \$535,000 grant from the National Oceanic and Atmospheric Administration's Office of Sea Grant, a part of the U. S. Department of Commerce, was matched by funding of \$267,500 from the N. C.

Department of Administration.

Now in its fifth year, the university-wide UNC Sea Grant Program provides financial support for projects designed to benefit North Carolina's coastal counties by improving the economy and

conserving the natural resources of that region.

The 1975 funding, highest since the Program began in North Carolina in 1970, will support 25 projects on four UNC campuses including North Carolina State University, East Carolina University, UNC-Wilmington and UNC-Chapel Hill. More than 30 scientists, lawyers, engineers and other university personnel will be leading UNC Sea Grant activities.

"This grant enables us to begin to seek solutions to problems facing North Carolina in its quest to manage and utilize its rich coastal resources," said Dr. B. J. Copeland, director of the UNC Sea Grant

Program.

Sea Grant investigators will be studying a wide range of coastal topics. Information useful to land-use planners will be developed in studies of geologic processes affecting coastal areas and in research to determine the value of salt marshes as they contribute to the abundance of fishery resources. Research will continue on the use of vegetation to create new marsh.

A study of water circulation patterns off the state's southeast coast should provide a model useful in evaluating the potential effects of offshore activities such as waste disposal or construction of

offshore power plants and deep-water ports.

Other Sea Grant-supported research will focus on managing coastal insects, reducing loss of wood in salt water environments to

the marine borer and developing eel "farming" techniques.

Studies of the law of the sea as it relates to North Carolina will continue. A legal researcher will monitor implementation of the state's coastal management act and develop recommendations for changes in the law or administrative guidelines if they are needed. Economists will study seafood marketing, compiling data on distribution patterns and inefficiencies in the marketing system.

Seafood scientists will continue developing seafood products, focusing on uses of mechanically deboned fish meat. They will assess effects of processing on seafoods and will seek to identify hazardous

microorganisms in seafood.

Advisory agents will work in the areas of fishermen education, coastal zone management, seafood harvesting and processing, insect management and coastal recreation.

The University of North Carolina Sea Grant Program Newsletter is published monthly by the University of North Carolina Sea Grant Program, 1235 Burlingotn Laboratories, Yarborough Drive, North Carolina State University, Raleigh, N. C. 27607. Vol. 2, No. 2, February, 1975. Dr. B. J. Copeland, director. Dixie Berg, editor. Second-class postage paid at Raleigh, N. C. 27611.

New publications

The following publications produced by the UNC Sea Grant Program are now available. To order copies, write: UNC Sea Grant Program, 1235 Burlington Laboratories, North Carolina State University, Raleigh, N. C. 27607. Residents of North Carolina may order one copy free.

Technical Operations Manual for the Blue Crab Industry. Miller, T., N. Webb and F. Thomas. UNC-SG-74-12. \$1.

Influence of Sedimentary Process on Grain Size Distribution Curves of Bottom Sediments in the Sounds and Estuaries of North Carolina. Custer, C. and R. Ingram. UNC-SG-74-13. \$2.

Sedimentary Structures of a Modern Lagoonal Environment: Pamlico Sound, N. C. Katuna, M. and R. Ingram, UNC-SG-74-

14. \$3.

Animal Colonization of Salt Marshes Artificially Established on Dredge Spoil. Cammen, L., E. Seneca and B. J. Copeland. UNC-SG-74-15. \$1.

Sea Grant film available for loan

"Waterbound—Our Changing Outer Banks," a film about North Carolina's changing barrier islands, is available for loan

to groups.

An outgrowth of Sea Grantsupported research by East Carolina University geologists Drs. S. R. Riggs and M. P. O'-Connor, the 16 mm., color film tells the story of the changing shape of the state's Outer Banks. It surveys the geologic processes which have and are acting on the state's coastline and outlines man's attempt to challenge these processes.

To borrow the film, write UNC Sea Grant Program, 1235 Burlington Laboratories, North Carolina State University, Raleigh, N. C. 27607. Proposed channel improvements to be done by the Corps of Engineers include (a) stabilization of Oregon Inlet with jetties, (b) a channel through the ocean bar at Oregon Inlet, (c) a channel from Oregon Inlet through Roanoke Sound to Wanchese and (d) a channel through Roanoke Sound to and through Albemarle Sound in deep water near the northern end of Croatan Sound. The Corps would also deepen and enlarge Wanchese harbor if the project is approved.

A bigger harbor and improved channels

(Continued from page 1)

Ward, seafood industries consultant of the N. C. Department of Natural and Economic Resources. "If we lose the state project in the General Assembly, we may lose the whole ball game," he said.

Appropriations must be made during this legislative session to meet stipulations made when the land was deeded to the state. Those stipulations require that construction on the complex begin before Dec. 31, 1976.

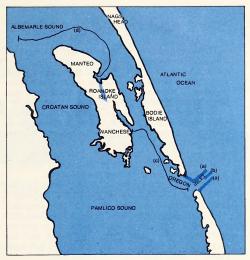
The state project, aimed at developing an area around an improved Wanchese harbor, would provide space and facilities for lease by the State Ports Authority to such private businesses as processing, fresh product handling, marine supplies, fuel, boat repair, ice or other support services. If funded, the state would provide water, waste collection and treatment, street access, shore power, bulkhead, docking facilities and land for lease to private development.

The complex would be located on approximately 20 acres of land which private landowners and Dare County donated. It is designed to meet tough pollution control standards, including vessel discharge outlets to a central disposal system.

The federal project, to be carried out by the Corps of Engineers, would include deepening and enlarging Wanchese harbor to 15 acres, 14 feet deep, stabilizing Oregon Inlet with dual jetties and dredging three channels, one from Oregon Inlet to Wanchese, one from Manteo (Shallowbag) Bay to deep water near the northern end of Croatan Sound and another through the ocean bar at Oregon Inlet.

Total cost of the portion of the project to be developed by the state is estimated at \$4.5 million. Estimates are that the federal project will cost from \$15 to \$20 million.

The first step in constructing the complex, which is to be administered by the State Ports Authority,



will be dredging and enlarging the harbor basin.

A study of how the Wanchese-Oregon Inlet projects might affect the economy of northeastern North Carolina indicates that during the five-year period after construction total capital investment would amount to \$30 million and 300 to 400 new jobs would be created. Annual payroll in the area would increase by \$2 million. While Dare County would benefit directly, the improvements would benefit the entire coast, especially the northeast sector.

The N. C. Division of Economic Development, the agency responsible for much of the project coordination, notes that with the improvements, Tarheel fishermen will be encouraged to buy larger, more efficient boats for increased offshore fishing. Total North Carolina landings should increase by 33 per cent, the division's food industries development section estimates.

Improved waterfront sites, reliable access through Oregon Inlet, reduced risk to boats and more reliable supplies of fish will attract investment to the area by processors, dealers and support industries from in-and out-of-state, the economic study says.

According to Ward, the potential for processing beyond sorting and icing is tremendous.

Already several large out-of-state processors have expressed interest in locating in the Wanchese area, according to Ward.

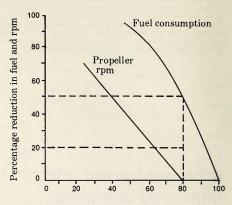
According to an economic impact study prepared by Randy Gray of the Office of State Planning, other benefits, approaching nearly \$1 million per year, could result from savings in running time to and from fishing areas, fewer delays due to sea conditions, reduced damages and vessel losses, more efficient operation of petroleum vessels and increased landings.

Save fuel by slowing boat

This graph shows the dramatic fuel savings that are possible by reducing boat speeds. Most boat owners know this fact, but this convenient graph gives you a basis for a quick estimation of the possible fuel savings and the amount of time that must be sacrificed at the lower speed.

To demonstrate the value of the graph: assume a fisherman's boat is designed to make 10 knots top speed (100 percent); if he operates at 8 knots (80 percent of his top design speed), he would consume only 50 percent of the fuel he would use at 10 knots and run at 20 percent lower RPM, as shown by the dotted lines on the graph.

To read the graph, choose on the bottom line the percentage of design speed to be used and run a perpendicular line through both the propeller RPM and fuel consumption curves. From the points where this vertical line intersects these curves, run horizontal lines at right angles and read the percent of fuel reduction and RPM on the left-hand scale.



Boat speed as percentage of design speed

Provided by the Marine Advisory Service at the Massachusetts Institute of Technology, Cambridge.

Workshop to explain areas of environmental concern

A workshop aimed at explaining the importance of dunes, wetlands, estuaries and other unique coastal features which may become "areas of environmental concern" under the state's Coastal Area Management Act will be held March 5 at East Carolina University's Mendenhall student

Sponsored by the UNC Sea Grant Program, the workshop will feature university scientists who have conducted research in environmentally sensitive coastal areas. Program speakers will detail the importance of dunes, wetlands and estuarine waters, as well as certain areas of social and historic significance. According to program organizer Dr. Simon Baker, UNC Sea Grant land-use advisory agent, speakers will provide scientific background on why these areas require special attention.

The conference, open to the public, should be of special interest to county, municipal and state officials involved in coastal planning. Under the state's Coastal Area Management Act, lands and waters where development would be unwise are to be labeled "areas of environmental concern," and development in these areas is to be closely controlled.

Keynote speaker for the workshop is Glenn J. Akins, chief planner of Oregon's Coastal Conservation and Development Commission. Akins will discuss Oregon's experiences in designating "areas of particular concern" as called for in that state's coastal management act.

University of North Carolina Sea Grant Program 1235 Burlington Laboratories North Carolina State University Raleigh, N. C. 27607



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University of North Carolina Sea Grant Program

NEWSLETTER

MARCH, 1975

1235 Burlington Laboratories . NCSU, Raleigh, N. C. 27607 Tel: (919) 787-2454

Striving for balance





There's talk about polluted drinking water, condemned shellfishing grounds, shabby development and carnival-type clutter spreading along North Carolina's coast. And it's true. There has been unwise development. Some areas like that on the left are looking cluttered. And waters are dirtier than they used to be.

But so far, it hasn't gotten out of hand. North Carolina's coast is still plump with the things that leave a good taste in your mouth after you've been there. It's not hard to find a beach like the one on the lower left. The fishing is still good. Crowds aren't overwhelming.

The coasts of other states have lost a lot of those "good" things largely because nobody thought to do much planning for the future. North Carolina is lucky because we can learn from past oversights. With a good look at what we've got in the coastal zone—and at what's likely to come—North Carolina can end the tug between the push to develop and the pull to save our natural resources. Through planning, dunes and marshes can co-exist with beach development.

The Coastal Area Management Act, passed just a year ago by the N. C. General Assembly, is legislation designed to bring people together to begin charting the course we will follow. Only the future can reveal our destination

Coastal planning:

It's sort of like making a budget

In your family, you probably budget your money so that it goes farther and does the most for you. In making a budget, you are planning how you will use your money in the future. Unless you are very rich, your income is limited and can be used to pay only a specific number of bills before it is all spent.

The natural resources in coastal North Carolina are also limited. The land, water, fish and minerals can be used only for a certain length of time at a certain rate before they, too, are spent. Before now, there hasn't been much planning, or budgeting, of how these unique resources will be spent. Too often, people have taken advantage of those resources much like the guy who squanders his paycheck before he gets it to the bank.

But in times when talk of shortages is not unusual and when more people flock to beaches each year, planning ways to stretch the "good things" on the coast becomes even more important.

North Carolina's General Assembly provided a tool that will be helpful in "budgeting" the state's coastal resources last year when it passed a law called the Coastal Area Management Act. Perhaps the most important feature of the new law is that

it sets the stage for planning for the future, for deciding today how land, estuaries, marshes and other areas on our state's coast will be used tomorrow.

Under the Act, areas of special value are to be set aside and used only in ways that do not destroy their uniqueness. Decisions to develop such areas, to be called areas of environmental concern, might compare with decisions you'd make before spending money out of your savings account. Only after careful study and weighing the pros and cons would you use your savings. And unless you absolutely had to, you probably woudn't make a purchase that would wipe out your entire savings. Development in areas of environmental concern would have to be approved by a state agency called the Coastal Resources Commission (CRC).

Local governments in the coastal zone are in charge of developing "budgets" for their lands and waters. They might decide, for instance, that some areas in the county are better for future industrial plants, while others are more suitable for residential districts. Their planning is similar to yours when you decide that some of your income is better spent on food, while another portion of it can go to recreation.

Budgeting in a family works only if members of the family show good will and stick to the spending plan. Similarly, if coastal management is to be effective, the state's citizens and local and state governments must act in a spirit of cooperation.

New law publications

Students at the University of North Carolina Law School have delved into the legal side of issues and problems in the coastal zone and in international oceanic waters. Their investigations are part of a course on the law of the sea taught by Dr. Seymour Wurfel, professor of law. Dr. Wurfel's teaching activities have been supported by the UNC Sea Grant Program.

Seven new publications representing the student investigations should be off the press by midspring. They are:

UNC-SG-75-04. Wurfel, S., Legal Measures Concerning Marine Pollution. Includes the following six articles:

"Pollution of the High Seas: The Oceans as International Rivers," C. Clinton Stretch.

"Artificial Islands: Possibilities and Legal Problems." Donna Le Febre.

"Marine Pollution Control and Man-Made Islands," Samuel A. Butts III.

"Fourth Amendment Problems in the Enforcement of Marine Conservation Laws." Paul Stam Jr. "International Ocean Dumping of Industrial Chemical Waste." Paul B. Stam Sr.

"Marine Pollution Problems in the Arctic." John

UNC-SG-75-05. Wurfel, S., Some Current Sea

Law Problems. Includes the following six articles:

"Innocent Passage: An Historical and Analytical Perspective." Charles D. Fagan.

"The U.S. Position on the Breadth of the Territorial Sea: National Security and Beyond." Kent Hedman.

"The Recovery of Vessels, Aircraft and Treasure in International Waters." Holmes Eleazer.

"International Law Pertaining to Crimes Aboard Aircraft." Robert E. Collins.

"Stare Decisis in the Developing Law of the Sea." David H. Rogers.

"The Emergency Marine Fisheries Protection Act of 1974 (S. 1988): A Solution, or Just an Extension of the Current Problems of Disorder." Ronald W. Burris.

UNC-SG-75-06. Almond, Michael A. Legal Aspects of Phosphate Mining in North Carolina.

UNC-SG-75-07. Winn, Edward L., Atlantic Lobster Fishing: Relevance to North Carolina.

UNC-SG-75-08. Dawson, Amos, The Law of Offshore Ports with Particular Reference to North Carolina.

UNC-SG-75-09. Kilpatrick, Joseph E., Oil and Mining Law Applicable to North Carolina Offshore Operations.

UNC-SG-75-10. Andrews, William P., Fishing Laws Pertaining to Waters Adjacent to North Carolina.

Sea Grant investigator studies coastal act

Twenty counties in coastal North Carolina are looking to the future—and making history at the same time. They are in the midst of drawing up plans for their future growth, plans that are sort of a blueprint for the way they'd like their lands to look in coming generations. Their action marks the first time in North Carolina's history that a large region of the state has sought to guide its growth and conserve its natural resources.

The planning undertaken by the counties and their municipalities is one in a series of actions during the past year aimed at putting coastal management in North Carolina on sound footing. Since the Coastal Area Management Act was enacted last April, a 15-member Coastal Resources Commission, the agency charged with overseeing implementation of the Act, has been active. Public hearings to learn more about areas which should be given special designation as "areas of environmental concern" have been held. A 47-member advisory board was appointed to assist in carrying out coastal management. And in late January, guidelines to be followed by local governments in drawing up their plans were announced.

But even though coastal management appears to be getting off on sound footing today, the real test is not likely to come for more than a year when counties do or do not put their plans into effect, according to Dr. Thomas J. Schoenbaum, UNC associate professor of law.

"I see a real danger that the plans will be drawn and adopted, but allowed to quietly slip away unless the law is amended," he said in a January in-

Coastal water is topic of April conference

The Southeastern Conference on Water Supply and Wastewater in Coastal Areas is set for April 2-4 at the Blockade Runner Motor Hotel in Wrightsville Beach.

The conference will review the state of the art in coastal water supply management and wastewater disposal. Some 20 speakers representing universities, government agencies and private planning and engineering organizations who have studied coastal water problems are featured.

Sponsored by the Coastal Plains Center for Marine Development Services, UNC Sea Grant and the UNC Water Resources Research Institute, the two-day event should be of interest to government officials, financiers and developers active in coastal areas and to citizens concerned about their environment.

A \$15 registration fee can be paid on arrival.



Counties affected by coastal act

terview. Under the Act, the law professor explained, local governments are required to draw up plans for growth which must be approved by the state. But whether the law requires localities to stick to their plans could be questioned.

With the aim of recommending changes which might make the Coastal Act or its administrative guidelines more effective, Schoenbaum has begun a study of the implementation of North Carolina's coastal management program. His research, funded by UNC Sea Grant, is aimed at monitoring the development of county land-and water-use plans and state guidelines to determine how closely they meet objectives set forth by the Act. His recommendations will be made available to legislators and other decision-makers.

The first year of Schoenbaum's proposed twoyear project will involve collecting and analyzing all guidelines prepared by the state, the county plans and reports from public hearings on coastal management. He will also keep an eye on the naming of interim and final areas of environmental concern by the Coastal Resources Commission.

As the law takes effect in 1976, Schoenbaum plans to determine if the plans and guidelines are actually being put into operation. From a series of case studies, he hopes to draw conclusions on the degree to which development is being controlled in areas of environmental concern, the extent of public participation in the planning process, the degree of cooperation among federal, state and local government officials and the adequacy of new agencies or institutions created by the Act.

The University of North Carolina Sea Grant Program Newsletter is published monthly by the University of North Carolina Sea Grant Program, 1235 Burlington Laboratories, Yarborough Drive, North Carolina State University, Raleigh, N. C. 27607. Vol. 2, No. 3. March, 1975. Dr. B. J. Copeland, director. Dixie Berg, editor. Second-class postage paid at Raleigh, N. C. 27611

Advisory services in mosquito and biting fly control

Training for control workers

—Available to county, municipal and private mosquito and biting fly pest control operators.

Services to local governments

- —Calibration of insecticide application equipment. Assistance with ultra low volume (ULV) truck-mounted aerosol machines which are replacing fogging equipment.
- —Identification of mosquito and biting fly species as the beginning of a local insect pest monitoring program. Monitoring provides knowledge of when and where insect pests strike hardest, enabling communities to apply insecticide treatment for a maximum return on dollars spent and environmental protection.

From the UNC Sea Grant Program and the N. C. Agricultural Experiment Station.

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University of North Carolina Sea Grant Program 1235 Burlington Laboratories North Carolina State University Raleigh, N. C. 27607



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University of North Carolina Sea Grant Program

NEWSLETTER

APRIL. 1975

1235 Burlington Laboratories NCSU, Raleigh, N. C. 27607 Tel: (919) 787-2454

Diking:

Less dredging but more mosquitoes

Maybe it was just their imaginations. But then, maybe it wasn't.

Residents of Southport, Wilmington and other coastal communities are almost sure that last year's mosquitoes were about the worst they ever remembered.

Some allowed that all the rain last August brought them out. Others speculated that the pesky insects came from nearby dredge spoil islands.

The islands—built of sand and mud pumped out of channel bottoms by huge dredging machines—aren't new. But a law, put into effect over a year ago, has created new conditions on the islands that some believe are responsible for adding to present mosquito problems.

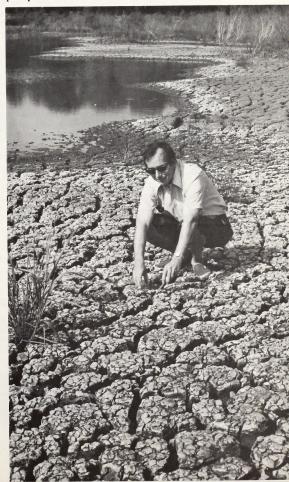
The new law requires that spoil dredged from navigation channels be dumped behind walls or dikes built around the islands. Diking is designed to slow the spoil's return to the channels, therefore reducing dredging's high costs and environmental wear and tear.

But while diking may offer a solution to one problem, it may be the source of another. According to Dr. R. C. Axtell, North Carolina State University entomologist, observations indicate that diked islands are a large source of mosquito production.

Axtell, whose UNC Sea Grant and N. C. Agricultural Experiment Station-supported research focuses on coastal insect management, is exploring the relationship between diking and increased numbers of mosquitoes. Axtell's years of coastal insect research have made him a world authority in his field. His research in this area, just getting underway, will also examine and evaluate ways to control insect outbreaks on dredge islands.

(Continued on page 3)

Dr. R. C. Axtell examines cracks in dried dredge spoil. Cracked spoil creates ideal conditions for mosquito production.



Communities replace fog truck with new insect-fighting equipment

"Hey mister, a truck carrying a strange-looking machine just went by my house. Sign on the side said 'mosquito control,' but no fog was coming out the back. When's the fog truck coming? Mosquitoes are awful out here."

Seen any strange-looking machines on trucks marked "mosquito

control" roaming the streets of your neighborhood?

You may well have. Many community mosquito and biting fly controllers in eastern North Carolina are switching from the old fogging method to something new called ultra low volume, or ULV for short. It could be that any strange-looking machines you've seen are part of the new ULV insect control technique.

ULV equipment puts out a fine mist that kills mosquitoes just as well as the dense fog, said Dr. R. C. Axtell, NCSU entomologist. What's more, ULV is cheaper, safer and easier to work with, he

added.

No more peering through insecticide pea soup with ULV either. The fine mist from ULV machines has little or no effect on seeing where you're going and what's coming at you, explained Axtell. So there's much less chance of traffic accidents than with the old fogging method.

A mixture of fuel oil and insecticide creates that dense white 'smoke' in the fogging method. ULV uses no fuel oil except for gasoline needed to run the truck. With today's high petroleum prices that can mean real savings to the community, scientists say.

Drs. Axtell and J. C. Dukes, in charge of research and advisory services in mosquito and biting fly control sponsored by UNC Sea Grant and the N. C. Agricultural Experiment Station, have been telling county, municipal and private pest control workers about ULV—and other techniques that can better control large insect outbreaks—in two-day training sessions.

Sessions were held in Morehead City and Wilmington last month.

Another will be offered in Manteo in April.

In these sessions, Axtell stresses that insect pest monitoring—or gathering data on precise times and conditions in which mosquitoes and biting flies are most abundant—is essential.

Monitoring can save money by enabling insect pest control operators to treat only when insects are most severe and in areas where

they strike hardest.

In the past, insecticides have often been applied on a regular calendar basis or as a result of phone calls from irate citizens regardless of whether the insects posed a severe nuisance or not. This can become costly and wasteful.

-Gayle Morton

Sea Grant depository publications

The National Sea Grant Depository at the University of Rhode Island's Pell Marine Science Library has published indexes of Sea Grant newsletters

for 1973 and publications for 1973 and the first half of 1974. These indexes are available for loan from the UNC Sea Grant Program office.

The University of North Carolina Sea Grant Program Newsletter is published monthly by the University of North Carolina Sea Grant Program, 1235 Burlington Laboratories, Yarborough Drive, North Carolina State University, Raleigh, N. C. 27607. Vol. 2. No. 4. April, 1975. Dr. B. J. Copeland, director. Dixie Berg, editor. Second-class postage paid at Raleigh, N. C. 27611

A sacrifice for research

"One, two, three, four ouch!"

No, those aren't the sounds of a karate beginner. They're the moanings of graduate students helping out on Dr. R. C. Axtell's research.

Axtell, N. C. State University entomologist, is trying to learn more about pesky mosquitoes and biting flies that can wreak havoc on a beach vacation. His goal is to come up with methods that local governments can use to control the insects for minimum cost and environmental damage.

Before Axtell and his co-workers can come up with the best ways to control those bothersome bugs, he's got to know when and where they strike hardest. To get that information, he's got to use good bait.

That's where graduate students come in. It's all part of getting an education — they tell themselves — standing there in one spot, shirt off, counting the number of mosquitoes, sandflies, horseflies and deerflies that land every minute. And because it's for the sake of research, they're able to do precious little to stop the painful nibbling.

It's not much fun, but it's the best way Axtell's found to get the the information he needs. He also uses rabbits and chickens and special light traps. But to solve a problem bothering humans, there's no substitute for the real thing.

-Gayle Morton



Diking, or building a wall to contain spoil on dredge islands, was initiated in North Carolina more than a year ago. Dikes are designed to slow the erosion of spoil into waterways. One of the unforeseen effects of diking appears to be an increase in mosquitoes.

Diking makes headaches for state entomologist

Diking has created new headaches for state entomologist Don Ashton. Since last year when dredge island diking was begun in North Carolina, he's been in a quandary over how to control the hordes of mosquitoes hatching on the diked spoil

Conditions perfect for salt marsh mosquito production begin as the spoil dries and cracks, Ashton explained. Mosquitoes deposit eggs on the walls of the cracks. Rain water collects in the cracks, providing moisture needed for the mosquito eggs to hatch, he said. "We've seen literally millions of mosquito larvae on the diked islands,"

'Salt marsh mosquitoes have been known to fly 65 miles," he continued. "So you can imagine what happens to people on the beach one-half mile away," he said.

While Ashton and his co-workers in the state's Division of Health Services Solid Waste and Vector Control Branch have been able to explain the problem's cause, they're pretty much at a loss for its cure. Flooding the islands or covering them with sand to eliminate areas where mosquitoes lay eggs are proposed remedies. Chemical treatment could be another, Ashton explained. But those methods require money and manpower which neither the state nor the counties have, he added.

"My contention is that it isn't the responsibility to eliminate the problem should be taken as the created. spoil is being dumped.

"It's just not economically feasible to treat the problem over and over," he said.

What is needed is research, the state's top insect expert said. "We need an entomologist and an engineer to work on this," Ashton said. He cited Dr. R. C. Axtell's research at North Carolina State University as a beginning. "But we need an engineer who can communicate with engineers involved with dredging," he said.

Seeking insect controls

(Continued from page 1)

Diking, it appears, sets up ideal conditions for the production of some kinds of mosquitoes. As the dredged material dries, permanent cracks form in the spoil. Mosquitoes lay eggs inside the cracks. With the right amount of rain later on, the eggs hatch, producing a horde of mosquitoes.

While understanding the relationship between diking and insect production poses a significant problem, the real challenge lies ahead in finding ways to control large outbreaks, according to

Flooding the islands or blanketing them with sand—two proposed solutions—would wipe out the mosquito breeding grounds. But in Axtell's view, neither solution is practical because of tremendous expenses involved.

Chemical insecticides may offer a temporary solution, the scientist said in a February interview. Careful study will be required to find ideal chemicals—those that can reduce the mosquito population without harming the delicate estuarine environment.

A class of chemical called insect growth regulators (IGR), now under study as a possible control method, appears promising, Axtell said. IGR works to interfere with the mosquito's development from one stage to another and appears to affect only mosquitoes, he explained. More research is needed, however, to make sure IGR doesn't interfere with the development of shrimp and other marine crustacea.

A refined petroleum product, which has proved to be an effective mosquito control, can be safely applied on the islands, Axtell continued. However, application must be closely controlled and timed so that the product, which breaks down, or loses its effectiveness, quickly, hits its target, he said.

Further research may show ways of handling dredge spoil to reduce the creation of mosquitobreeding areas. This would provide a more long term solution, Axtell said.

The end of the problem is not foreseeable since dredging is an ongoing activity that each year adds more spoil to the islands, the scientist explained. When the currently-used diked islands are filled in of the county or state to rectify the situation," Ash- several years, others will take their place and still ton said. He believes instead that permanent steps more potential mosquito breeding grounds will be

-Gayle Morton

Arming against those indoor sand fly attacks

Do you find yourself serving as a midnight snack for sand flies?

Some relief from the annual sand fly attack you find yourself battling right inside the house may be in sight.

Drs. R. C. Axtell and J. C. Dukes, NCSU entomologists working with UNC Sea Grant and N. C. Agricultural Experiment Station support, have come up with a strategy that may stop the sand fly foot soldiers before they get under your roof.

Their battle plan: Knock them off at the window screens, one of the places they rest before charging into the house. The weapon: chemical insecticides applied to the screens.

Any coastal resident who's tried to spend an evening relaxing at home knows that ordinary window screens just don't keep those tiny flies out.

But Axtell and Dukes, who learned that the pesky insects sit on the screens before darting through the tiny openings, reasoned that a good defense might be to expose the sand flies to insecticides when they land on the screen.

After testing various insecticides on different types of screen, the researchers aren't willing to guarantee that treated screens will keep all the sand flies out. But their experiments show that the number entering and biting can be greatly reduced.

Specifically, the researchers dipped aluminum and fiberglass screening into an eight percent mixture of the chemical, malathion, and another mixture of eight percent propoxur to get the best kill, according to Axtell.

Researchers subjected the treated screens to the elements for varying time periods to determine how long the insecticide would work.

Under laboratory conditions, malathion and propoxur killed 96 out of every 100 sand flies for 28 days. But according to Axtell, the length of control on home window screens would depend on weather conditions.

Off the press

Two UNC Sea Grant publications relating to insect pest management in coastal areas are available from the UNC Sea Grant Program Office, 1235 Burlington Laboratories, N. C. State University, Raleigh, N. C. 27607. They are listed below, along with other recently-published UNC Sea Grant publications.

UNC-SG-74-08. Training Manual for Mosquito and Biting Fly Control in Coast-

al Areas. Axtell, R. C. \$3.

UNC-SG-73-03. Public Opinion on Insect Pest Mangement in Coastal North Carolina. Gerhardt, R. R., J. C. Dukes, J. M. Falter, and R. C. Axtell. \$1.

UNC-SG-74-10. Evaluation of Twin Trawl Shrimp Fishing Gear and Addendum. Chleborowicz, A. G. \$1.

UNC-SG-74-12. **Technical Operations Manual for the Blue Crab Industry.** Miller,
T., N. Webb and F. Thomas. \$1.

T., N. Webb and F. Thomas. \$1. UNC-SG-74-16. Proceedings of a Conference on Coastal Management. Center for Marine and Coastal Studies. \$3.

UNC-SG-75-02. Nekton Population Dynamics in the Albemarle Sound and Neuse River Estuaries. Hester, J. M. and B. J. Copeland.

University of North Carolina Sea Grant Program 1235 Burlington Laboratories North Carolina State University Raleigh, N. C. 27607



Second-class postage paid at Raleigh, N. C. 27611



University of North Carolina Sea Grant Program

NEWSLETTER

MAY, 1975

1235 Burlington Laboratories NCSU, Raleigh, N. C. 27607 Tel: (919) 737<u>-2454</u>



The ocean:

Our next dumping grounds?

The island community of Wrightsville Beach lies nestled between the mighty Atlantic and North Carolina's port city of Wilmington. Glittering waters, an easy-going, family atmosphere and clean, sandy beaches lined with handsome beach cottages—all make the island one of North Carolina's most popular beach resorts.

Popularity has made Wrightsville Beach a prosperous place to live and work. But for the town's governing officials, growth has created problems, real puzzlers that require more complex solutions than coastal communities have relied on in the past.

Perhaps the most urgent problem Wrightsville officials find themselves confronting is that of disposing of increasing quantities of human wastes. They and officials in other fast-growing beach areas are finding that the old ways of disposing of waste—individual septic tanks and municipal sewage treatment plants—just aren't capable of handling the large amounts of sewage generated in coastal communities today.

The waste problem is further complicated by the huge influx of people during summer months. Disposal systems must be able to handle the increased quantities of waste generated. In Dare County, for instance, the population climbs from 3,500 in winter to some 35,000 in the summer.

One proposed solution to the problem, now receiving serious examination by North Carolina state and local officials, is to use the ocean as dumping grounds. Several states on both the east and west coasts are already pumping wastes collected in coastal areas through large pipelines into the ocean. Some have found ocean outfalls, as the

(See "Ocean," page 3)

seascope



Dr. B. J. Copeland

Dr. Copeland is director of the University of North Carolina Sea Grant Program. A professor of zoology, botany and marine sciences at North Carolina State University, his research interests have focused on estuarine water quality and ecology.

Sea Grant looks at ocean outfall problems

The finite land area of the Outer Banks and the increasing population there are providing great difficulties for waste disposal. Porous sands can support only a few septic tanks but not nearly enough to dispose of the volume of wastes produced in some areas. Thus, seepage from septic tanks is imposing water quality problems in nearby surface waters. Conventional treatment facilities must still dispose of effluents, usually in nearby productive and aesthetically-important sound waters. Land and underground disposal pose serious threats to precious groundwater resources.

To combat these problems, some municipalities are proposing regional collection of sewage, treatment and disposal offshore through ocean outfalls. Ocean outfalls impose several obvious problems—e.g., proper design, knowledge of ocean currents and mixing, economic alternatives, and lack of criteria and policy by state and federal

regulatory agencies.

The University of North Carolina Sea Grant Program has initiated two studies to focus on the ocean outfall problems. A short-term survey of existing data and information concerning physical characteristics of North Carolina's nearshore continental shelf is almost completed. This study will focus what we already know, which is scant, on the ocean outfall issue as it pertains to North Carolina. A second, more long-term study is underway to provide a model of nearshore currents and mixing, along with collection of pertinent, accurate data. Another study will begin this summer on the septic tank problem. This work has the objective of determining density and design of septic tanks on the Outer Banks where they may be deemed a viable solution to waste disposal.

As important as these studies are, they are only the beginning of the amount of information required to deal with the waste disposal problem. Much more research is needed and will be conducted. We are working with State agencies, the N. C. State University Center for Coastal and Marine Studies, the UNC-Chapel Hill Marine Sciences Program and the UNC Water Resources Research Institute to design and carry out work to yield pertinent short- and long-term information concerning ocean outfalls and alternative means of waste disposal. Obviously, these studies must begin immediately and provide information on a continuous basis.

Island management publication printed

Managing dredge islands for waterbirds is the topic of a new UNC Sea Grant publication.

Entitled "Proceedings of a Conference on Management of Dredge Islands in North Carolina Estuaries," the publication reviews work done by UNC Sea Grant investigators Drs. James



Photo: Robert N. Elliott

Parnell and Robert Soots. They have made a three year study of dredge island plant and animal life and their potential management. In addition, the publication surveys the legal and administrative aspects of possible dredge island management.

The conference on managing the islands was held last May and attracted some 70 participants from 24 private and gov-

ernment agencies.

Copies of the publication UNC-SG-75-01 may be obtained from the UNC Sea Grant Program Office. North Carolina residents may order one copy free of charge.

The University of North Carolina Sea Grant Program Newsletter is published monthly by the University of North Carolina Sea Grant Program, 1235 Burlington Laboratories, Yarborough Drive, North Carolina State University, Raleigh, N. C. 27607. Vol. 2, No. 5, May, 1975. Dr. B. J. Copeland, director. Dixie Berg, editor. Second-class postage paid at Raleigh, N. C. 27611.

Ocean outfalls could solve sewage disposal problems (Continued from page 1)

piping systems are called, satisfactory. Others have met with problems.

Some officials and coastal engineers contend that ocean outfalls creased waste problem may be to could be the answer to coastal waste disposal problems. With ocean outfalls, they believe the state would come out better environmentally and economically than with other proposed disposal techniques such as higher levels of sewage treatment, disposing of treated wastes on land or pumping wastes into natural caverns deep in the

At this point, the idea of stretching the sewer line into the ocean remains riddled with questions. Although outfalls have worked in other places, no one is sure whether the physical conditions in North Carolina's offshore zone are suitable for ocean outfalls. Before decisions regarding outfalls can be made, more information on the physical characteristics, on waves and currents and the mixing of waters in the state's offshore area is needed.

Already North Carolina's Department of Administration has initiated a comprehensive examination of the environmental and economic costs of ocean outfalls in North Carolina. The study, organized under the direction of Dr. Ernie Carl of the N. C. Office of State Planning, will be the basis for state policy on ocean sewage

According to Carl, the study has short and long term aspects. In the short term the goal is to bring together information that is already available on the state's offshore environment and to relate data from other states' outfall systems to North Carolina's specific needs. Dr. Leonard J. Pietrafesa, North Carolina State University physical oceanographer working with UNC Sea Grant support, has contributed substantially to this part of the study which should be complete later this spring.

In the long run, study organizers hope to compile more complete knowledge about the state's entire offshore area through additional research. Eventually state planners hope to be able to predict the economic effect of outfalls at any location on commercial fishing, shellfishing, land values and community growth.

Research to learn more about North Carolina's ocean currents and water circulation patterns in an offshore area from Morehead City to the state's southern boundary is already underway. Under a grant from the UNC Sea Grant Program, North Carolina State University physical oceanographers Drs. L. J. Pietrafesa, C. E. Knowles and C. C. Tung are studying to determine where wastes pumped through the outfalls would eventually be transported. In some other states, sewage discharged through outfalls has washed back onto beaches because current action was not fully understood before pipes were stationed. Data from the Sea Grant-supported study will be fed into the computer, with the long-term goal being to predict the destination of effluents pumped into the sea.

Ocean outfalls could provide an answer for coastal communities facing increasing sewage problems, at least until man learns to efficiently and safely recycle wastewaters for their eventual re-use. But before we can safely rely on the ocean as dumping grounds, dozens of questions need answers. Hopefully, they won't be long in

Life has become alot more complicated over the years, especialty on the coast. In crowded areas, sandy beach soils have become saturated with man's wastes and water suppties are threatened with contamination. One way to handle the inpipe treated sewage into the sea.



Getting rid of wastes:

A review of the alternatives

We've tried septic tanks and municipal sewage treatment plants to handle the wastes we generate in the coastal area. In North Carolina, neither has been a rousing success environmentally.

There are yet other methods that could be used to rid the coastal zone of wastes. But they too seem to have problems.

Speakers at the Southeastern Conference on Water Supply and Wastewater in Coastal Areas surveyed some proposed disposal techniques.

In his summary remarks, Dr. B. J. Copeland, director of the UNC Sea Grant Program and professor of zoology at North Carolina State University, gave an overview of disposal techniques discussed and cited potential environmental problems associated with each. Following is a rundown of disposal techniques, problems associated with and information needed to make wise decisions regarding each, as spoken to by Dr. Copeland.

Septic tanks

Widely used in North Carolina's coastal

Problems: Seepage of nutrients, organics, poisons and disease organisms into nearby surface and sub-surface waters, upsetting the use of existing shallow groundwater for water supply. Evidence shows that disease organisms from septic tanks have reached estuarine waters resulting in their closing for commercial shellfishing.

Needed information: Before more septic tanks are permitted there is need for complete soil testing and hydrology data for realistic siting and sizing.

Conventional treatment plants

During the very near future, conventional treatment facilities and the disposal of treated wastes in nearby areas seems to be the most available disposal solution.

Problems: Even with sophisticated treatments, effluents containing some nutrients and pathogens will be disposed into sounds and estuaries. This has a potentially damaging impact on productive estuarine areas.

Needed information: Need to develop an economical means of high level or other treatment to minimize the impact of effluents in nearby coastal waters.

Land disposal

On-land disposal of waste may be an economical solution and at the same time provide fertilizers. This technique has proven to be a good means of disposing of animal wastes in the state's Piedmont re-

Problems: Nutrients, trace metals and pathogens in the sewage flow through the soil to groundwaters and then into surface waters. Holding ponds, apparently necessary for land disposal pretreatment, are a potential hazard in areas with high water tables, Availability of enough land areas for effective disposal on the barrier islands is another problem.

Needed information: Basic knowledge of soil-water characteristics of coastal soils should be completed and the rates of disposal on land need to be equated with the lands' capacity to absorb and hold wastewater. Additional information needs to be gathered on the use of vegetative buffers between land areas where waste is disposed and nearby waters.

Deep well injection

Disposal by this method involves pumping wastes deep into the earth. It does not appear suitable for coastal use.

Problems: Contamination of groundwater supplies could result since it is difficult to determine the fate of the injected materials and leakage of these into the sounds and ocean is possible.

Ocean outfalls

A technique of collecting, treating and disposing of domestic waste by piping it into the ocean.

Problems: Outfalls not properly designed and located could result in sewage washing back onto beaches. A more subtle effect of outfalls is that they could deprive estuaries of varying amounts of needed freshwater. Instead of going into the estuaries, freshwater channeled through outfalls winds up

Needed information: Currents and water mixing patterns off the North Carolina coast should be plotted before outfalls are permitted. Design criteria must be collected to enable coupling of the outfall with environmental conditions and to prevent localization of sludge at the outfall site.

One community's disposal dilemma

Wrightsville Beach officials took major steps to deal with their town's growing waste disposal problem on a communitywide scale in the mid-60s.

Septic tanks, having multiplied over the years with an ever-increasing influx of residents and vacationers, were overtaxing the ability of the sandy beach soil to absorb increasing amounts of sewage.

So the town got together and built a sewage treatment plant. Treated wastewater from the plant is discharged into Shell Island Sound, estuarine waters running between the island community and the mainland.

By 1972, town officials saw the writing on the wall: Growth was outpacing the treatment plant's capacity to process wastes. Changes in permit-letting rules and agencies concerned with water quality brought plans for plant expansion and improvement to a standstill.

Today, the treatment plant is operating at capacity, yet the glistening waters and sands of Wrightsville Beach attract more people every year. Shellfishing is no longer permitted in waters where the town's sewage effluents are pumped. Although the treatment plant can't be blamed as the sole polluter, many are convinced that its discharge largely contributed to the closing of shellfishing waters.

Under the Federal Water Pollution Control Act, municipalities may obtain federal funds to upgrade sewage treatment facilities. A plan for the design of such facilities and their impact on the environment must be approved by a state environmental board and the Environmental Protection Agency.

Wrightsville officials have taken steps to find solutions to the waste disposal problem and to obtain federal funds for upgrading facilities. They have submitted a plan to the state proposing eight alternative means of waste disposal. The plan, designed to fulfill 201 facilities planning requirements under the Federal Water Pollution Control Act, names ocean outfalls as the most economical and environmentally safe alternative. As of yet, the plan has not been approved.

A historic look at coastal waste disposal

State and local officials are casting an eve toward the Atlantic as the next dumping grounds for man's wastes.

What has led to serious consideration of piping treated sewage into the sea from coastal areas?

Col. Paul Denison, principal engineer of Henry von Oesen and Associates, Inc., consulting engineers in Wilmington, provided some background on coastal sewage disposal in remarks to the Southeastern Conference on Water Supply and Wastewater in Coastal Areas, held in Wrightsville Beach in early April.

"Historically, as man began to occupy the coastal margin, he simply drilled shallow wells in the surficial sands to supply water for drinking and other purposes," Denison said. "At the same time, he discharged his sewage wastes back into the same surficial sands or land areas, using conventional septic tanks or even more primitive disposal means," Denison explained.

Before development boomed, the lands could supply man with ample fresh water and could absorb his wastes, Denison continued. But as more people began using the coastal zone, the lands'

"The specific problem that we haven't really faced up to is the one of domestic wastewater treatment and disposal in the beach and estuarine areas."-Col. Denison.

ability to furnish man's needs was increasingly

To supply growing demands for fresh water, communities turned to municipal water supply and distribution systems. Denison continued. But sandy coastal soils can produce only limited quantities of fresh water and some coastal community and private systems are finding that they may soon be unable to supply needed quantities of water.

According to Denison, the problem of wastewater disposal in the coastal area is even more challenging than that of water supply.

"The specific problem that we haven't really faced up to is the one of domestic wastewater treatment and disposal in the beach and estuarine areas," Denison charged. Commercial and industrial wastes do present disposal problems but industry is being required to meet continuously increasing controls on effluent discharge,

Growth and development have resulted in everincreasing domestic sewage discharges into the surface sands and soils bordering on coastal waters,

(See "Soils," page 6)

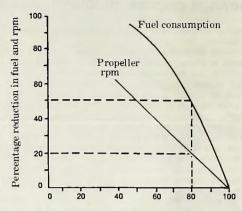
You can save fuel by slowing boat speed

We goofed. When we published this graph on fuel savings in the February Newsletter, we failed to notice that the propeller rpm line was drawn in the wrong place. Here, with our apologies, is the corrected version of the graph and directions on how to use it.

The graph is designed to show how you can save fuel by reducing the speed of your boat. Most of you know this, but this graph allows a quick estimate of the possible fuel savings and the amount of time that must be sacrificed at lower speeds.

Here's an example of how the graph works: assume a boat is designed to make 10 knots top speed (100 percent); if the boat is operated at 8 knots (80 percent of its top design speed), it would consume only 50 percent of the fuel it would use at 10 knots and run at 20 percent lower rpm, as shown by the dotted lines on the graph.

To read the graph, choose on the bottom line the percentage of design speed to be used and run a perpendicular line through both the propeller rpm and fuel consumption curves. From the points where this vertical line intersects these curves. run horizontal lines at right angles and read the percent of fuel reduction and rpm on the left-hand scale.



Boat speed as percentage of design speed

Provided by the Marine Advisory Service at the Massachusetts Institute of Technology, Cambridge

Soils can't absorb wastes (Continued from page 5)

where the capacities of these soils to assimilate the wastes "have been taxed beyond tolerable limits,"

he added.

health and sanitation problems, Denison said that evidence shows that excessive waste discharges into coastal soils are beginning to enter and ad-

versely affect nearby estuarine waters.

In Denison's opinion, which he bases on exten-Denison said. Discharge has increased to a point sive study of the problem in coastal North Carolina, ocean outfalls offer the most viable solution to the problem of waste disposal in the coastal zone. "In my opinion, he concluded, "adequate In addition to presenting potentially serious and optimum protection of our environment in North Carolina is being delayed due to lack of guidelines and initiatives (by the State) on the important question of ocean outfalls."

University of North Carolina Sea Grant Program 1235 Burlington Laboratories North Carolina State University Raleigh, N. C. 27607



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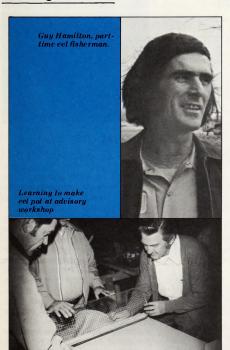
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University of North Carolina Sea Grant Program NEWSLETTER

June, 1975

1235 Burlington Laboratories NCSU, Raleigh, N. C. 27607 Tel: (919) 737-2454

Fishing for eels:



Guy Hamilton is one of those Americans who earns his living knocking dents out of bashedin cars. The red paint spattered across the belly of his gray workshirt and a tag on his windbreaker proclaiming that he's an employee at "Dealers Auto Service" testify to that.

It's not that the work or the money at his dad's body and fender shop in New Bern is bad. But like

Part-time work that is paying off

alot of folks trying to hold the reins on today's galloping prices, Hamilton wanted to pick up some extra cash in his spare time. Last spring, he hit on an idea that, put into action, has beefed up his bank account—with a small investment in time and money.

That idea: fishing for eels.

Hamilton came across the idea from contacts with University of North Carolina Sea Grant advisory agents. With their help, he built his first eel traps and learned about good baits and fishing locations. He opened his business a year ago with eight traps. This spring Hamilton has more than 30 in the rivers new New Bern.

For work that rarely takes more than three hours a day, eel fishing can be well worth the time, Hamilton found. During one week in the height of the season last fall, 12 of Hamilton's traps caught 600 pounds of eels. At 50 cents per pound, Hamilton could see his part-time work beginning to pay

Most of the eels that Hamilton and other Tarheel eel fishermen land wind up in Europe. Dealers travel the coastal area collecting and transferring eels from holding tanks to live-haul tank trucks. The trucks take the eels to processing plants where they are frozen alive, a requirement for selling them abroad.

Hamilton is just one of hundreds of North Carolinians who have taken up eel fishing under the direction of UNC Sea Grant advisory agents. Five eel harvesting and handling workshops held in coastal areas of North and South Carolina and Georgia, numerous television appearances and hundreds of informal contacts have provided facts needed to launch many individual eel operations. Advisory agents began working on eel harvesting and handling technques in 1972.

It is estimated that one-half million pounds of

See "Eel," page 2

seascope



Dr. William L. Rickards

Dr. Rickards, assistant director of the UNC Sea Grant Program, is a principal investigator of the eel culture project.

Eel project offers research and help

At least two factors contributed to the initiation of North Carolina's first eel farming unit, located near New Bern. Channels for exporting full-grown, wild eels from North Carolina to European markets have been firmly established. And several Japanese eel culture organizations have sought new sources of elvers in the eastern part of the state.

A project to investigate the feasibility of farming the American eel using techniques developed by the Japanese for other eel species was started in North Carolina in 1973. The initial limited project efforts appeared promising and the program is being expanded and improved. The eel farming demonstration facility now has the capacity to grow from 48,000-60,000 eels in four outdoor ponds, as well as a series of indoor elver holding and feeding tanks.

This demonstration facility is not a new concept. The Cooperative Extension Service has operated demonstration farming units for many years, but the existence of such a fish farming unit in North Carolina is new to the state. It has been set up to provide potential eel farmers with a source of up-to-date technical information as well as testing ground for innovations and new ideas which might be beneficial to eel farmers.

Through the personnel based at the New Bern facility, anyone interested can obtain information concerning eel farming techniques. This includes elver harvesting and handling, feeding and stocking rates and details of pond construction. Information is also available on the present market potential for cultured eels.

In addition to continuing work on techniques for growing eels, future plans include a study to determine projected production costs, market values and profit capabilities of eel farming. Such an economic analysis should provide project personnel with knowledge needed to modify culture operations to reduce costs.

An ongoing activity of the project is to get information gained from the study into the hands of individuals who may be interested in farming eels. Assistance is available from project investigators on problems or questions concerning eel culture. The names, addresses and phone numbers of those who can supply you with information are found in the next column.

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Eel info

For information on harvesting wild eels contact: Skipper Crow P. O. Box 51 Morehead City, N. C. (919) 726-7341 To learn more about eel farming and Sea Grant's work with eels contact the following: Walt Jones or John NCSU Eel Culture Project P. O. Box 2494 New Bern, N. C. 28560 UNC Sea Grant Program 1235 Burlington Labs

North Carolina State

Raleigh, N. C. 27607

(919) 737-2454 Eel exports up

(Continued from p. 1)

eels were exported from North Carolina in 1973 and again in 1974. These amounts are up some 400,000 pounds from 1972's eel export estimates.

As the number of eels shipped out of the state has gone up, so has the amount that eel fishermen have been paid for their catch. Prices have more than doubled from 23 cents per pound in 1972 to 50 cents per pound in 1974.

UNC Sea Grant agents have also lent a hand to eel dealers and exporters. In 1974, the exporting end of the eel business got a shot in the arm when East Carolina Industries, a rural coperative for migrant laborers in Fairfield, opened a freezing plant. Sea Grant agents have provided technical assistance to the cooperative on all aspects of the eel-centered enterprise, including the manufacture of eel traps, operation of a live-haul truck, freezing and marketing.

A farm for growing eels

Ever thought of eel farming? UNC Sea Grant researchers have. They've set up a demonstration eel farm three miles up the Neuse River from New Bern to capture baby eels, or elvers, and raise them to marketable size.

Europeans and Japanese regard the eel as a delicacy. The fish is so popular in Japan that demand for the food exceeds supply. While Europeans eat mature eels weighing three-quarters to one pound—which are already being exported from North Carolina—, the Japanese prefer smaller eels weighing one-quarter to one-half pound. The six to eight inch long elver is also popular as bait.

The eel farming project got underway in 1973 with a grant from the Coastal Plains Regional Commission to UNC Sea Grant engineering advisory agents through the North Carolina State University Industrial Extension Service. The grant supported a pilot study on the feasibility of eel farming in North Carolina. Study results showed a potential for eel culture in the state and UNC Sea Grant took over funding for the project in January.

Many of the techniques being put to use at the New Bern eel farm have been adopted from the Japanese who in the past several years have developed successful eel harvesting and farming methods.

A visit in March, 1973 from Dr. Kazutami Nishio of the eel research and development section of a Japanese eel farming cooperative provided UNC Sea Grant investigators with valuable basic information on when, where and how to catch and care for the elvers. While Japanese techniques were developed for farming a Japanese eel, Sea Grant investigators have found many of their methods useful in raising the American eel, common in eastern North Carolina.

The first step in eel farming is capturing tiny elvers. In the late winter and early spring, when they begin heading upstream, elvers are easily caught with dip nets around dams, in streams and in other areas where their inland movement is restricted and they tend to bunch up, according to Sea Grant researchers William Rickards and Walt Jones.

Jones, Rickards and John Foster, an assistant on the project, captured thousands of tiny elvers one day in mid February as they were fighting to make their way over a small dam near Newport. Indoor holding tanks at the eel culture laboratory located on Weyerhaeuser land were home for the elvers until early May when they were transferred to an outdoor holding pond.

When caught, elvers must be handled with care



Walt Jones, Bill Rickards and John Foster capture elvers in creek near New Bern.

to avoid damaging the skin. Damaged skin weakens the young eels, leaving them vulnerable to disease, according to Rickards and Jones. A further safeguard against disease is a two-day chemical "bath" given the elvers just after they are caught.

It is in the indoor tanks that elvers must acquire a taste for a specially prepared diet—a critical step in their successful growth. Elvers that have been accustomed to feeding on live food must learn to eat a mixture of minced deboned fish, starch, vitamins and salt.

By early spring, when they are transferred to an outdoor pond the elvers are entering a stage of rapid growth which is given an extra boost by the warm temperatures of the spring and summer months. According to Rickards, if the fall is mild, elvers caught in February should be ready for the bait market before winter.

In some Japanese eel farming operations, nearly half of the elvers held in indoor tanks for the first two months after capture have died, largely because of disease. So far this year Sea Grant researchers have lost less than two percent of those elvers captured in February. Rickards attributes this low mortality rate largely to the use of well water in the tanks this year. Last year Neuse River water was used and mortality rates were significantly higher. Naturally occurring disease organisms in the river water could have been contaminating the water, Rickards thinks.

Tips on killing, cleaning and cooking eel

Here are some directions for killing, cleaning and cooking eel. Next time you catch one, you might try eating it instead of throwing it away.

Killing and Cleaning

The simplest way to kill eels is to put them in a deep container, sprinkle them with salt (don't bury them in it!) and add enough water to cover them. Let them soak in the solution two to four hours.

This method of killing helps remove the slime layer. Newly-killed eels should be thoroughly washed in clean water to remove the salt and slime. Soak them for a half hour in cold water and then scrape or scrub the eels. A steel bristle brush works best to remove the last traces of the salt and slime.

After washing, the eels must be gutted. If you recipe calls for skinned eel, it's easier to skin the fish before gutting. To skin it, put a nail through the eel's head and drive the nail in a wooden post or something similar.

Using a sharp knife, cut through the eel skin three inches behind the head all the way around. Be careful not to cut into the gall bladder which lies behind the head. Turn the skin back and peel it off, using

pliers if necessary.

When gutting an eel, sawdust, salt, a rough cloth or hands dipped in dry salt will help you get a firm grip on it. Insert a knife or sharp-pointed scissors into the vent and cut along the belly line toward the head. Cut up to the gills.

Cut toward the tail two inches past the vent to expose the kidney. Remove the kidney and pull out the large vein along the backbone if possible. Scrub and wash out the gut cavity to remove all traces of blood from the backbone. Rinse the eel in clean water.

Gutted and cleaned eels may be quick frozen and stored at -20° F. Since eels have a high fat content, they should be packaged to protect against rank odors and flavors and drying out.

Fried Eels

Skin the eels. Split them down the middle and clean. Cut in three inch lengths and wipe dry. Roll in crumbs, dip in slightly beaten egg diluted with two tablespoons of water, and roll again in crumbs. Fry in deep hot fat (375° F) three to five minutes. Garnish with parsley and slices of lemon.

-Gavle Morton

Eels as food and bait

(Continued from p. 3)

Should eel farming prove successful in North Carolina, where could eels be sold? The primary target is the Japanese food market. A Japanese-backed food processor had opened a plant in Swansboro to package eel for export to his country. Currently, the plant has closed, apparently because of an insufficient and inconsistent eel supply. Eel

farming could answer those problems.

Eels are also a popular bait used by sport fishermen. In the past, eight inch elvers have sold for as much as 50 cents apiece. Sea Grant researchers aren't sure at this time how eel farming would affect the market price of eel as bait. At this time, the bait market appears to have promise as an alternate outlet for eel, at least on a limited basis, said Rickards.

-Gayle Morton

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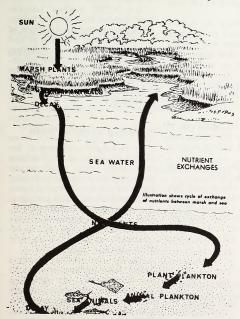
University of North Carolina Sea Grant Program NEWSLETTER

July, 1975

1235 Burlington Laboratories NCSU, Raleigh, N. C. 27607 Tel: (919) 737-2454

Marsh:

There's more there than meets the eye



This drawing shows the exchange of energy between the marsh and estuarine waters. Marsh grasses capture the sun's energy. As they die, energy-filled, decaying grass particles wash into nearby waters where fish feed on them. Fish and other sea animals store the energy until men eat them or until they die and decay. When they die, nutrients from their bodies fertilize the marsh, making it a rich environment for grasses.

Next time you're making a beeline for one of North Carolina's beaches, put your imagination to work.

Don't think of those acres of grassy marsh and glistening waters you pass as simply more grass and more water. Instead, picture them as a great pastureland where your favorite seafoods grow lush on a bountiful supply of nutrients.

Unlike the green meadows you passed where cows grazed leisurely on clover and fescue, the marshy pasture still poses a mystery for scientists. But one thing that most are convinced of is that marsh grasses are a source of life-giving nutrients for fish and shellfish, and eventually for you.

Researchers believe that for at least part of their life cycles, flounder, shrimp, oysters, croakers, spot and dozens of other fish grow to adults on a diet of nutrients that originate with grasses in the marsh and shallow estuarine waters. Those grasses are apparently the first link in a complex cycle that turns the sun's energy into foods that animals—and men—can use to fuel their bodies.

Scientists generally believe that the productivity of marsh grasses has a direct effect on the productivity of fish in estuarine waters.

Jim Brown of the Division of Marine Fisheries, a part of the state's Department of Natural and Economic Resources, is convinced that the fishery is directly related to the amount of marsh. North Carolina's coastline and fisheries catch illustrate his point, he says.

As the amount of marsh acreage increases from north to south along the state's coastline, so does the value per acre of the fishery resource, Brown noted. As further evidence, he cited a study that showed a decrease in fish production proportional to the destruction of marsh in a Florida estuarine area.

A simple explanation of how nutrients from marsh and seagrasses work their way to fish goes like this. Grasses grow tall and stout in their fertile environment. When they die, the grasses crumble into tiny particles which scientists call detritus. Bacteria, fungi and other microorganisms feed on

(See "Energy," page 3)

State actions that encourage wise development in marshlands

As the value of natural resources go, marsh would have to rate among North Carolina's most important. Marsh grasses are at the bottom of a chain that produces food for a protein-hungry world and dollars for the coastal community.

In the 60s, it became apparent that the state's marshlands were being gobbled up by development. It's estimated that about 10 percent of the marsh we once had has been lost and that 30 percent has

been altered but is still functioning.

In 1969, the N. C. General Assembly passed a law designed to safeguard the future of marshes and the state's fishery resource. Called a dredge and fill law, the legislation requires that anyone planning to build in or change the marsh in any way first get a permit by having his plans approved by the state. A federal permit

is also required before making changes in marsh.

The state's Coastal Area Management Act should also afford protection for marshes, according to Jim Brown of the N.C. Division of Marine Fisheries. "There are many legitmate uses of the coastal area," he said. "But even though they're legitimate, they're not always compatible. The Coastal Area Management Act should provide the organization and direction for using lands that are best suited to certain uses." he said.

According to Brown, the man in charge of putting the state's dredge and fill legislation into effect, North Carolina's dredge and fill law and the cooperation established between state and federal agencies in dredge and fill activities is a model other states are following. Implementation of the law is recognized as among the

nation's best, he added.

A major reason, Brown says, is that the law was written in a way that makes implementation possible. But while North Carolina leads in implementing dredge and fill, Brown's division doesn't always find the going smooth.

Failure to obtain convictions and stiff penalties for violations of the law is a major frustration for Brown. Last year 29 dredge and fill cases went to court. In many, photographs and survey reports were presented as evidence of violation.

But of those 29 less than 70 percent were found guilty. The average fine per conviction was less than \$24, Brown's records show.

Research to learn more about the dynamics of marsh and fish production promises to help attach a value to the natural systems, Brown said. "In most court cases, we need to convince the court that these (marshes) are valuable areas," he noted. In addition, research findings, which have been helpful in setting up present management controls, will be important in directing goals for the future and evaluating the success of past work, Brown said.

Sea Grant annual report available

Sea Grant in North Carolina, a magazine reviewing 1974 Program activities, is now available. To order copies, write: UNC Sea

Grant, 1235 Burlington Laboratories, North Carolina State University, Raleigh, N.C. 27607.

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Seafood industry conference set

Recent research developments that could be of use to seafood harvesters, handlers and processors will be discussed and demonstrated in a conference on July 29 at Carteret Technical Institute, Morehead City.

The day-long meeting, expected to get underway around 9 a.m., will cover developments that have grown out of a seafood handling and processing pilot study by NCSU seafood scientists Neil B. Webb, Frank B. Thomas and T. M. Miller. Sponsors of the meeting are UNC Sea Grant, Coastal Plains Center for Marine Development, National Fisheries Institute Inc. and the NCSU School of Agriculture and Life Sciences.

The NCSU Seafood Laboratory, located next door to Carteret Tech on the second floor of the Department of Natural and Economic Resources building, will hold open house the following day. Laboratory staff will be on hand for discussions and demonstrations of mechanical deboning.

Banking seminar held

A late-April conference designed to acquaint the banking community with problems in financing the commercial fishing industry attracted some 30 bankers from eastern North Carolina. The day-long seminar, held in Greenville, was sponsored by the N.C. Bankers Association in cooperation with N.C. State and East Carolina Universities.

During the seminar bankers heard from various aspects of the fishing industry including the fisherman and seafood dealers and processors. They were reviewed on steps involved in vessel financing. An afternoon session focused on several loan guarantee programs, such as the Small Business Administration and Farmers Home Administration, which are designed to reduce the risk of making loans.

Unraveling mysteries of the marsh ecosystem

In North Carolina three teams of scientists are conducting research aimed at understanding the relationship between coastal grass and fish production. Although they share this common long-term goal, their current efforts are directed at unearthing the secrets of different, and very specific, aspects of the marsh-estuarine ecosystem.

Briefly, one group of scientists is studying the relationship between grasses and animals growing in the marsh. Another is examining the importance of eel grass, an underwater grass, to aquatic animal life. The third is determining how microrganisms, such as bacteria, increase the food or nutrient value of detritus, decaying particles of marsh and eel grasses. All three projects promise to yield important information toward a more complete understanding of the marsh-estuarine ecosystem.

The work of UNC ecologists A. E. Stiven and E. J. Kuenzler, supported by Sea Grant, centers

Energy from marsh grasses eventually is fuel for you

(Continued from page 1)

and attach themselves to the detritus. Larger marine organisms, including some species of fish, feed on the tiny decaying grass particles. Bigger animals consume smaller ones until the food chain reaches man.

While farmers have reliable estimates on how many pounds of grain their hogs and cattle must eat to grow one pound of meat, no one has yet related the amount of grass growing in the marsh and estuaries to the amount of seafood produced. Scientists believe that before sound decisions can be made on how we will use marshes in the future, more information is needed to determine how changes in the marsh might affect our fishery resources. Ideally, researchers would like to be able to predict what the destruction of one acre of marsh might mean in terms of lost fish production.

North Carolina has nearly three million acres of marsh and estuarine waters. If the belief proves true that marsh and fish production are related, protection of our estuaries and wetlands is essential to a continued healthy fishing industry.

As more people choose to work and play in the coastal area, planning how marsh and estuarme resources will or won't be used becomes critical to the future of the fishing industry and to one of man's major food resources.

But before we can plan, we need answers to questions about the importance of marsh grasses to seafoods. The intricacies of the food chain that begins in the marsh need to be better understood. in the salt marshes. In attempting to determine the dynamics of that system, they are looking at the number and kinds of animals that feed on the detritus of Spartina alterniflora, North Carolina's dominant marsh grass. They aim to develop models that will show mathematically how productivity of marsh grass and detritus compares to the amount of detritus eaten and animal-life produced. This part of their research will help determine if marsh animals are dependent on detritus for their energy. In better establishing the importance of marsh grass to fish productivity, Stiven and Kuenzler are studying the amounts of detritus transported to the open estuaries from salt marsh.

Results from this work may help man determine whether he can manipulate the marsh environment and thus, the production of fish. With this data, scientists hope to be able to predict, for instance, how fertilization of marshes with sewage would

affect fishery production.

Research at the Atlantic Estuarine Fisheries Center supported by the National Marine Fisheries Service and led by Dr. G. W. Thayer, a task leader in the Center's ecology division, focuses on phytoplankton, marsh and sea grasses (particularly eel grass) growing in the estuarine waters and their importance to fish and shellfish in the aquatic environment. Scientists at the Beaufort lab are seeking to determine the rate at which energy in detritus moves into and through components of the estuarine ecosystem, the routes energy follows and the speed at which it is used by marine animals, including fish.

The NMFS researchers hope to be able to predict how environmental change, such as an increase in water temperature caused by the discharge of nuclear power plant cooling waters, would increase or decrease fishery resources. If they are successful, their work should furnish environmental managers a valuable tool for predicting the impact of man's activities in the coastal area.

Dr. John Hobbie, North Carolina State University ecologist, is working with Sea Grant support to get the facts on the role bacteria play in the detritus-based food chain. Microbes, it is believed,

(See "A study," page 4)



Smooth cordgrass, a dominant N.C. marsh grass.

Getting the ok to develop marshlands

So you own a piece of coastal property and would like to develop it. If your land classifies as marsh, you might like to bone up on procedures to follow before making any changes in your land and the services available to you from the Estuarine Studies Section of the Division of Marine Fisheries

in Morehead City.

In North Carolina marsh is defined as those lands that are subject to regular or occasional flooding by sound water due to anything other than winds of gale or hurricane force. The state's law on developing marsh requires that anyone planning to excavate or do fill work in estuarine waters or marshlands get a permit.

The purpose of dredge and fill legislation wasn't to stop all development. It was designed, instead, to encourage the type of development that is compatible with marsh

and estuarine environments.

The Estuarine Studies Section offers a consulting service to assist potential developers in making plans that will meet state requirements. The consultants are available to help draw up plans that might be acceptable to developers and state review agencies.

Application for state and federal permits can be made on the same form and submitted to the Division of Marine Fisheries Estuarine Studies Section. Applications for state permits are reviewed by 12 state agencies and can be commented on by adjoining property owners. The U.S. Army Corps of Engineers directs applications to the proper agencies for the federal permit.

If your permit application is not approved, you can request a hearing. A sevenman review board will hear your case and can override the state's denial of a permit.

After a permit is granted, the Estuarine Studies Section conducts a regular monitoring program to make sure changes in the marsh are made in accordance with the permit. Regular aerial surveys and on-site visits are made by enforcement personnel.

Those cited for not following plans expressed in their permit will be taken to court. If convicted, the developer must begin operating within the permit's limits and often must pay a fine and the costs of restoring areas that were changed without permission.

Further information on dredge and fill requirements can be obtained from the Estuarine Studies Section of the Division of Marine Fisheries, Morehead City, N.C., (919) 726-7021.

A study of marsh microbes

(Continued from page 3)

contribute substantially to the nutritional value of detritus.

Hobbie is looking at the number of microbes that accumulate on detritus as it ages and at different times during the year. His project also aims to determine the effects of such environmental factors as temperature, salinity and the quantity of nitrogen and phosphorous on the production of bacteria.

University of North Carolina Sea Grant Program 1235 Burlington Laboratories North Carolina State University Raleigh, N.C. 27607

A third goal is to establish the rate at which many bacteria are used by young fish and invertebrates as they eat detritus.

Hobbie's work is in an early stage, but results should be useful to agencies managing marsh and fishery resources. If, for example, his research showed that nutrients added to the marsh increased the number of bacteria and fish production increased as a result, decisions to dispose of nutrientrich sewage in marsh might be justified.

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University of North Carolina Sea Grant Program

NEWSLETTER

AUGUST, 1975

1235 Burlington Laboratories NCSU, Raleigh, N.C. 27607 Tel: (919) 737-2454

Dredge island drama...

...a story about birds and men



A colony of royal terns nest on almost bare sands of lower Cape Fear River dredge island.

White ibises nest in dense thicket on Battery Island.



It wasn't New York's Grand Central Station or Chicago's O'Hare Airport or a Los Angeles freeway jammed bumper to bumper.

But that island in the lower Cape Fear River had to be about the busiest spot in the world for 7 o'clock on a muggy July morning.

For once, man wasn't a character in the drama. The island, you see, belonged to the birds, thousands of swooping, scooping, sweeping, swishing, screaming birds. Thousands of adults circled in the air. Thousands of young stampeded on the beach. All screamed. It was a birdwatcher's paradise.

Royal terns held crown to the island, built over the years by the ongoing struggle to keep navigation routes dredged deep. The last time he brought dredging machines to the island, man actually helped royal terns. Spoil dumped there some three years ago buried plant life, leaving the kind of barren sands that the white-plumed, orange-beaked birds prefer for nesting. In June they showed up on the island 10,000 strong to rear their young.

Battery Island is only a few miles down river (See "Researchers," page 4)

What's so special about a bird?



There's something special about birds, something that seems to strike pleasant notes on people's heart strings.

Our actions show it. We build backyard feeders, stock them with special bird food and entertain ourselves with outdoor bird drama. We join organizations for watching and protecting feathered animals. We support research to learn more about them and how we can insure that our activities don't bring them harm.

Why are birds important to us?

For many, it's hard to put into words. Ask someone why they like birds and their gut reaction is

likely to be, "I just do."

Mrs. Edna Appleberry, often referred to as the dean of birding in North Carolina, has concrete reasons for her number one fascination. "We'd be in horrible shape without them," she asserted in a recent interview at her Wilmington home. Birds, she said, "make up part of the web of life. People don't seem to understand the universal pattern. If we make a hole in it, something harmful might move in or something else might die," she said.

"Few realize that birds are working for us all day and night," Mrs. Appleberry continued, refer-

"Few realize that birds are working for us all day and night."—Mrs. Edna Appleberry.

ring to the large number of insects birds eat. Birds form a complete web around our earth with different species occupying different "layers" from the ground up, she explained. "Each species is suited to his own sphere," she said, citing as one example the woodpecker's long beak for picking insects out of wood.

Dr. Thomas L. Quay, North Carolina State University bird scientist, sees birds as kind of a convenient link between man and nature. "Birdwatching is an easy way for people to get close to nature," he said one day last July. "It can be done any time and any place, it's inexpensive and appeals to all kinds of folks," he said. "It's different from nuclear physics or oceanography. Everybody can do it—alone or in groups."

Quay pointed to the importance of birds in research dealing with ecology, population dynamics,

animal behavior and even medicine.

According to UNC-Wilmington biologist James Parnell, birds are important in the coastal economy. During his more than 10 years at UNC-W, Parnell has seen large numbers of birdwatchers come to the coast to enjoy their hobby—and spend their vacation dollars. Birds, Parnell added, are part of what makes anyone's vacation at the beach unique.

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Feeding the gulls on the Cedar Island-Ocracoke ferru.

Men and birds:

Making an effort to live in harmony

A swarm of laughing gulls-the kind that'll funding from 1971-74. practically eat right out of your hand-whirled season's nesting.

The island had been all theirs-until that big crane-like machine resting over by the water's edge showed up. A man had used the dragline to rebuild the dike that surrounds the island and is meant to slow erosion. The machine's presence was an almost certain sign that plans to dump new dredge spoil on the island were on tap. Several tons of spoil dumped there while the birds were nesting would mean disaster for many young gulls.

Jim Parnell and Bob Soots, UNC Sea Grantsupported biologists who've been studying life on dredge islands five years now, saw the calamity that appeared to be developing.

But just like in the old movies, disaster was avoided. A call by scientists and cooperation from officials at the Wilmington district office of the U.S. Army Corps of Engineers saved many of the gulls. When Corps officials heard the problem, they altered dredging schedules as much as was feasito raise their young and move on.

habitats. It is just one development of research that Program office.

Parnell and Soots conducted under UNC Sea Grant

Their work initially focused on plant and animal over the grassy island they had claimed for this succession on dredge islands. But before long, birds had become their research emphasis.

While dredging is often thought to be environmentally harmful, Parnell and Soots found that islands built with spoil make ideal nesting sites for many species of waterbirds. In fact, periodic dumping, which buries vegetation and leaves a barren, sandy surface, is beneficial to those birds that prefer little or no plant growth, researchers found.

Different kinds of birds prefer different levels of vegetation, Parnell and Soots discovered. As the natural succession of grasses, shrubs and trees progresses, the kinds of fowl on the islands change.

Looking to the time when dumping might be moved from the islands, Parnell and Soots sought ways to control plant growth so that those species needing only sparse vegetation could continue nesting on the islands. They found that selected herbicides provide effective control. Other methods need further testing, they say.

The results of their research were presented at a ble to avoid the birds. By delaying dumping on the May, 1974 conference which attracted some 70 island a few weeks, the gulls had a better chance participants from more than 20 government agencies and private organizations. The proceedings of Such cooperation has proven to be a successful that conference (publication number UNC-SG-75way to maintain existing colonies and their 01) are now available from the UNC Sea Grant

Researchers get set to count waterbirds

(Continued from page 1)

from the royal tern colony. But in some respects, lnitial efforts have been devoted to developing the desert-like tern island is worlds away.

Making your way through the tufted, prickly grasses and dense woody thickets is almost impossible on some parts of Battery. But it's not necessary to go into the "jungle" to see the island's number one attraction—its hundreds of longlegged herons, egrets and ibises balancing half awkwardly, half gracefully on springy tree top

If you do carve your way into the shrubs, you're likely to see woody nests built strategically among the branches and young birds stumbling over vegetation many times their size, striving to get the knack of flying.

Unlike their royal tern neighbors, the larger waterbirds prefer a place like Battery Island where plants have grown thick and tall since spoil was last dumped there in the early 60s. Although it's apparent that the level and amount of plant life on Battery have increased over the years, no one is sure if the number of birds has also grown. But this year, thanks to the work of UNC Sea Grant-supported biologists, we have reliable estimates that to establishing reliable census techniques, the some 5,000 of the spindly birds made summer homes on Battery.

Getting tabs on Battery's bird population is only the tip of the iceberg for biologists Drs. James Parnell of UNC-Wilmington and Robert Soots of Campbell College. Their goal is to count coastal waterbirds nesting in colonies from Virginia to South Carolina. That, as most folks know, is a lot of territory. Estimates are that about 20 colonial species nest on the Tarheel coast.

Parnell and Soots hope that their census of waterbird populations will provide a set of figures against which future bird counts can be compared. By being able to see changes in the numbers of birds, government agencies and private organizations may be able to take steps to prevent the extinction or serious decline of any species.

The first phase of the biologists' proposed three year censusing project got underway this spring.

counting methods that are reliable, economical and fast and that don't unduly harm the birds. For their work to be of real value, their counting techniques must be easy to duplicate in the future.

During May, June and early July, Parnell and Soots, with student assistants Leon Jernigan and Robert Needham, spent long, hot days counting nests from the air and on the ground. For those species who nest in the open, aerial photography is a reliable counting method. But for birds like laughing gulls, herons and egrets who build nests in dense vegetation, using ground counting methods appears to be the only reliable way to get a grasp on their numbers.

Closely related to their Sea Grant work is a U.S. Fish and Wildlife Service project in which Parnell and Soots are locating all coastal heron rookeries and getting a count of herons in North Carolina. Project sponsors believe that changes in heron populations could be a gauge to more subtle environmental changes.

While Parnell and Soots have devoted this year coming two years will be spent conducting the

After the two-year population count, the researchers will put their findings into an atlas that promises to be of use to many government agencies, private organizations and individuals whose activities are in the coastal zone. The atlas will map the location of bird colony nesting sites and indicate the population of species at each site. It will further relate vegetation levels and the physical characteristics of islands to the kinds of birds found there.

While more people will know more about our bird resources from Parnell's and Soot's work, it probably won't make too much difference to the birds. If conditions remain favorable, they'll probably keep coming back to North Carolina's dredge islands, forever sweeping, swishing, swooping and certainly screaming.



and Robert Needhamlook over bird censusing data.

Bob Soots, Leon Jernigan

te

Birding:

A chance for amateurs to contribute

By the late 1940s and early 50s, birdwatchers all over the country had drawn big red circles around Wilmington, N.C. on their maps. For many, the Tarheel shipping town stood as sort of a mecca, a birdwatcher's heaven.

Wilmington's birds didn't gain their fame by accident. If not for the hard work and dedication of one Mrs. Edna Appleberry, they might have gone unnoticed by the outside world.

It was she and her young college student assistants who startled the nation's birdwatching community with a record-breaking Christmas count of more than 160 species and a spring count of 184 species in the early 50s. Wilmington's annual Christmas count had steadily increased since 1945 when Mrs. Appleberry took charge and 68 species were sighted. But a count of more than 160 placed the port city in front of most, if not all, other communities.

Mrs. Appleberry was in her 40s before she was, as she says, "pushed" into birding. She never earned a formal degree in ornithology. But she can probably tell you as much about birds and their behavior as a formally educated bird scientist.

That represents one of the unique things about birding. It's something all kinds of people with all kinds of backgrounds can do—and do well. And as they practice their hobby, sighting and studying birds and their habitats, they contribute to everyone's understanding of birds.

Mrs. Appleberry's contributions, and those of thousands of other amateur birdwatchers, have helped place birds among those animals that are best known taxonomically and ecologically, according to Dr. Thomas L. Quay, North Carolina State University ornithologist. "Amateurs have contributed as much as professionals to our knowledge of birds," he said.

Such organizations as the National Audubon Society, to which many amateurs belong, have thrived on private support, Quay said. It is through Audubon's support of education, research and enforcement programs that much information has been gained. Quay also pointed out that several of the nation's privately endowed museums have made significant contributions to the study of birds

Mrs. Appleberry is almost 81 now. She says her vision has dimmed in the last few years, cutting into her birdwatching. But her interest remains strong.

She isn't willing to call herself a "good birder" or to take much credit for her contributions. But she is convinced that amateurs "can be of tremendous help to professionals." But to be of help "they must be honest in their reporting," she said.

What's the attraction of birdwatching? Mrs. Kitty Kosh, a neighbor of Mrs. Appleberry who rarely leaves the house without a pair of field glasses dangling around her neck, finds it hard to explain. But the way her face lights up at the mention of her hobby, you know it's simply heartfelt fun.

"I guess the greatest joy for me is just watching," she said. "There's not a lot of competition to see who can spot more birds," Mrs. Kosh said. "One of the biggest joys of finding something rare is sharing it," she said.

Birding isn't a hobby that takes a lot of fancy equipment, Mrs. Kosh added. "A lot of people just put up a bird feeder and watch with their bare eyes. Others invest in a pair of binoculars and a bird book. Those that really get interested might buy a spotting scope, a device that looks a lot like a telescope," she explained.

Watching birds isn't always a relaxing hobby either, Mrs. Kosh said. "It's easy to cover a lot of ground," she noted. Birding like she does in the winter—often from 8:30 a.m. to 2 o'clock in the afternoon—it's easy to see why you wouldn't call it relaxing.

Government protection for birds and wildlife

What protection does government provide for those birds nesting on North Carolina's dredge islands?

Many of the birds that nest there are protected by federal migratory game laws, according to Frank Barick, chief of the section of the Wildlife Resources Commission responsible for interagency coordination. North Carolina cooperates with the federal government by helping enforce laws that prohibit the taking of migratory birds, he said.

A bill that would have enabled the state to lend further protection to endangered species was tabled in the 1975 General Assembly. But according to Barick, the WRC is pressing forward to develop an endangered species protection and restoration program. Of the waterbirds, brown pelicans and the southern bald eagle would likely be included on a state endangered species list, Barick said.

The Commission, under authority of statutes which designate it as the agency responsible for the protection and enhancement of wildlife, has mapped out a threephase endangered species program, Barick said. The first step is to compile information on species which may be threatened. Secondly, the Commission will conduct studies to determine more about the exact status of various species and factors influencing their status, with the goal being to develop recommendations for maintaining endangered wildlife. Finally, the Commission will use the recommendations to establish regulatory and restoration programs aimed at safeguarding the perpetuation of the species, according to Barick.

University of North Carolina Sea Grant Program 1235 Burlington Laboratories North Carolina State University Raleigh, N.C. 27607

Publications

The following publications are available from the UNC Sea Grant Program office.

Proceedings of a conference on management of dredge islands in North Carolina estuaries. Parnell, J. F. and R. F. Soots, ed. UNC-SG-75-01.

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Synopsis of marine fisheries. Chestnut, A. F. and H. S. Davis. UNC-SG-75-12.

The role of North Carolina in regulating offshore petroleum development. Kilpatrick, J. E. UNC-SG-75-09.

Deepwater port development in North Carolina: the legal context. Dawson, A. C. III. UNC-SG-75-08.

North Carolina fishery law: its relation to international, federal and sister state law. Andrews, W. P. Jr. UNC-SG-75-10.

Fishery resource conference

A conference exploring the abundance and use of fishery resources in North Carolina's coastal waters is set for September 18-19 at New Bern's Holiday Inn.

Speakers at the two-day meeting will update participants on the status of fishery resources and the impact of foreign fishing and extended jurisdiction on those resources. Regional resource management will also be discussed. Later sessions will delve into problems associated with seafood processing, utilization and marketing.

Conference sponsors are UNC Sea Grant, the Coastal Plains Center for Marine Development Services, NCSU Agricultural Extension Service, National Marine Fisheries Service and the N.C. Department of Natural and Economic Resources.

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University of North Carolina Sea Grant Program

NEWSLETTER

SEPTEMBER, 1975

1235 Burlington Laboratories NCSU, Raleigh, N.C. 27607 Tel: (919) 737-2454

Advisory services:

A hotline of useful information for you

Lawrence Austin's clam garden is paying off. When he and UNC Sea Grant advisory agents planted seed clams in shallow water on the Pamlico Sound side of Hatteras village, they were just testing the possibility of small "backyard" clam gardens. The seed clams they planted cost one cent apiece. Today, less than two years later, the garden's a success and Austin's selling the clams for as much as eight cents each.

Jim Corprew of Coinjock will probably find the back-straining work of pulling in heavy eel and crab pots from deep Albemarle Sound waters easier this fall. A hydraulic powered pot puller that he and Sea Grant advisory agents have installed on his small boat promises to make his work easier and quicker.

Thomas Barnwell and other members of the Hilton Head (S. C.) Fishing Co-op, Inc. have taken steps to set up an eel farm that could produce eels

for export to overseas and northern markets. They were able to see and learn first hand from UNC Sea Grant's eel culture demonstration facility in New Bern before launching their own South Carolina-based business.

Blue crab plants in eastern North Carolina have made changes in processing procedures based on Sea Grant advisory recommendations. Such changes should help the plants meet increasingly stringent quality requirements.

Brunswick and other coastal counties are beefing up their insect pest control programs with more effective machines and methods. In formal training sessions and informal chats with Sea Grant advisory agents, local pest control operators have learned about more effective, economical ways to control mosquitoes and biting flies. Coastal communities hope new techniques will help them control insects that bite into their tourist incomes.

Coastal planners and local government officials are in the midst of drawing up plans for growth as required by the state's Coastal Area Management Act. To help them better understand state planning guidelines, Sea Grant's land-use advisory agent (See "advisory," page 4)

Jim Corprew's fishing should be easier with hydraulics



S. C. fishing co-op members examine Sea Grant eel farm



Ed Clemmons of Brunswick County checks insect monitoring device



The men of Sea Grant advisory services



At the advisory helm

Leigh Hammond 133 1911 Building N.C. State University Raleigh, N.C. 27607 737-2138

Leigh Hammond is at the hub of UNC Sea Grant advisory services. It is his job to see that the marine advisory program stays on track and rolls smoothly.

Hammond is dedicated to putting together a program that gets information into the hands of people who can use it and benefit. His ear is tuned to the wishes, gripes and problems of the coastal community and state agencies with responsibilities in the eastern reaches of our state. From the feedback he gets through advisory agents, coastal citizens and state and local officials, Hammond and Sea Grant administrators try to build an advisory services program that targets on coastal needs.

When he isn't wearing the hat of advisory services coordinator, Hammond is assistant vice chancellor for university extension at NCSU.

> Simon Baker Room B. 1911 Building N.C. State University Raleigh, N.C. 27607 737-3197



Land-use planning

Simon Baker's title is hard to swallow all at once. He calls himself a land-use planning advisory services agent.

What that means is that he is available to help counties, towns and state agencies that are up to their necks in devising land-use plans as called for under the state's 1974 Coastal Area Management Act.

Baker's background is in geography, aerial photography and other remote sensing techniques-all of which equip him to provide technical assistance to local and state planners.

Through a series of films, Baker is trying to explain in terms everyone can understand how natural and man-made forces act on the coastal environs, why coastal resources are important and what planning and management is likely to mean to the state's citizens.

Jim McGee P.O. Box 2727 E. C. U. Greenville, N.C. 27834 758-6138

Commercial fishing



Sumner Midgett, Hughes Tillet and Jim McGee are advisory agents to Tarheel fishermen. Information and innovation characterize their work.

Their mobile library that travels throughout the northeastern counties is stocked with information on all sorts of topics relating to fishing-from boat building and weather to preparing a seafood feast. They make regular trips to fill some 20 information display racks stationed throughout the Albemarle region. The racks provide the fishing community with convenient access to helpful reading. Small meetings in coastal communities are another avenue for updating fishermen on new gear, new kinds of fishing, business management and other topics. And because Midgett and Tillet have been around the water and fishing most of their lives, they

Managing insect pests



Dick Axtell 3324 Gardner Hall Department of Entomology N.C. State University Raleigh, N.C. 27607 737-2832



Jim Dukes P.O. Box 809 Morehead City, N.C. 28557 726-6841

Managing insect pests is the name of the game for advisory agents Jim Dukes and Dick Axtell. Their goal is to help coastal communities do a better job of controlling mosquitoes and biting flies with less expense environmentally and economically. With more effective less costly methods, the agents hope counties will be able to manage large outbreaks of insect pests and keep tourists happy.

Axtell and Dukes have studied coastal insects under UNC Sea Grant and Agricultural Experiment Station funding since 1970. In the past two years, they begar taking research findings to coastal pest control operators through training sessions. These continuing sessions update pest control operators on current application requirements and new control methods. The agents also assist in calibrating equipment for safety and to get the most for dollars spent.

Dukes and Axtell are available to assist in tailoring pest management to the needs of specific localities. This involves pinpointing the times and locations of severe insect problems and mapping controls to combat specific

problems.





Sumner Midgett Camden, N.C. 27921 336-4790

Hughes Tillet P.O. Box 272 Wanchese, N.C. 27981 473-3937

can understand the fisherman's needs and problems.

But advisory services is more than handing out a book or holding a meeting. As Midgett, Tillet and Mc-Gee practice it, advisory services is also getting up to their elbows in work—either by helping a fisherman equip his boat with improved gear or testing new options in fishing. For example, the advisory agents are trying to iron the kinks out of growing clams and oysters in shallow sound waters. If they are successful, people living near these shallow waters could possibly garden these shellfish for their own consumption and

The advisory agents are available to try to help on just about any problem relating to fishing. And if you think you've got a good idea for a new way to do something, they're eager to hear it too.

Seafood technology

If your living depends on seafood—either harvesting, processing, shipping or serving it-you just might like to know the staff at the Sea Grant Seafood Laboratory in Morehead City.

Ted Miller, Dave Hill and Skipper Crow are Sea Grant advisory agents bent on improving seafood quality. Better tasting and longer-lasting seafood, they reason, means more income for everyone from fishermen to retailer—and happier consumers.

Miller, Hill and Crow, along with Frank Thomas from the NCSU food science department in Raleigh, have already assisted many Tarheel blue crab processing plants by providing plans for more efficient, sanitary operations. They continue working with the blue crab industry-and with finfish processors-to help both meet increasingly stringent sanitation requirements.

When they're not in the field, Miller, Thomas, Hill and Crow might be found in the lab testing more reliable methods of handling and storing seafoods for better quality and longer life, developing new products from

Ted Miller Dave Hill Skipper Crow

P.O. Box 51 Morehead City, N.C. 28557 726-7341







Rill Rickards UNC Sea Grant Program 1235 Burlington Laboratories N.C. State University Raleigh, N.C. 27607 737-2454



John Foster P.O. Box 2494 New Bern, N.C. 28560



Walt Jones

633-0414

Eel farming

Walt Jones, John Foster and Bill Rickards are engaged in a pretty unusual project: They're trying to see if you can farm eels-raise them from tiny elvers to marketable size in enclosed ponds-in coastal North Carolina. They've got an experimental eel farm where right now thousands of the squirmy fish are growing. Eels, you see, are a hot export item for European markets and are in demand as sport fishing bait in this country.

But while Jones, Foster and Rickards are engrossed in all aspects of raising eels—including food preparation, elver harvesting, disease analysis and treatment and pond construction—they don't just want to sit on their findings. Their eel farm in New Bern is open as a demonstration unit for anyone who might be interested in eel farming-and they're eager to share what they've

Jones and Foster are headquartered at the New Bern demonstration farm. Rickards is at the Sea Grant office in Raleigh, where he doubles as assistant program director. They're all open to questions.

"trash" fish, or testing new ways to detect seafood deterioration.

Questions about harvesting wild eels should be directed to Skipper Crow. He can help with building traps, baiting, fishing and marketing eels from Carolina waters.





129-F Schauh N.C. State University Raleigh, N.C. 27607

Advisory agents are eager to hear from you

(Continued from page 1)

teamed up with the UNC Institute of Government for three workshops for planners.

Sea Grant advisory agents. What do they do and how can you benefit from them?

In simple terms, Sea Grant's advisory agents are information carriers. Under their hats, they carry facts, figures and know-how about a wide range of marine and coastal problems. Their goal is to get that information into the hands of people who live and work in the coastal zone. Their hope is that new knowledge put to use will help make living standards higher.

While much of their information comes from work that university researchers do, advisory agents also learn from coastal citizens and from their own experiments done in cooperation with those citizens. They might, for example, pitch in to work with fishermen or seafood processors to work out cheaper, easier and faster ways to do things. But no matter where they get their knowhow, advisory agents are available to share it with all who might put it to work.

Sea Grant's advisory services agents offer services in a variety of areas. Several are devoted to assisting the fishing community, others work with seafood processors. Three are investigating the do's and don't's of eel farming and making their findings available to potential eel culture operations. Two are working with government agencies which deal with controlling insect pests. Another is available to assist local and state agencies involved in land-use planning. Plans are that another advisory agent, not yet named, will work with the coastal recreation industry.

The names, addresses and telephone numbers of these agents are found on pages 2 and 3 of this newsletter. If you think any of them could be of assistance, they are eager to hear from you.

Coastal films available to groups

"The Currituck Film," a 23-minute, 16mm color film documenting problems of coastal development and one county's attempt to deal with those problems, is available from the UNC Sea Grant Program. 1235 Burlington Labs, N.C. State University, Raleigh, N. C. 27607.

Written and directed by Les Thornbury, the film explores action taken by Currituck County, North Carolina's northeasternmost county, to manage pressures for development so that unique natural resources

are not threatened.

"Waterbound—Our Changing Banks," a 16-mm color film describing geologic processes acting on the state's Outer Banks and man's attempts to deal with those forces, is also available.

Requests for the films should be submitted at least two weeks prior to the anticipated viewing date and should include dates preferred for showing. Sea Grant asks that borrowers return the films in the same condition as they are received within three days of the showing and that return postage be paid.

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University of North Carolina Sea Grant Program

NEWSLETTER

OCTOBER, 1975

1235 Burtington Laboratories NCSU, Raleigh, N.C. 27607 Tel: (919) 737-2454

The eternal battle against erosion

PAMLICO BEACH—Ed Miller stomped through the tall grass to the edge of his river-front property north of this coastal community where the Pungo and Pamlico Rivers roll together. He trained an eye on the ground to look out for rattlers

some of the boys said they'd seen.

But it wasn't the fear of a sudden, unexpected snake bite that had Miller worried that hot afternoon. What bothered him was more subtle and more deceptive than the hollow sound of a rattle or an ugly head poised for strike. Ed Miller, you see, has anguished for years as he watched his land crumble little-by-little into the Pungo River. Ironically, the River's sparkling waters—the very attraction that is bringing more vacationers and second-home seekers to North Carolina's mainland shores—are chiseling away at the real estate, and the dreams, that belong to Miller and hundreds like

Erosion is one of those forces with which people everywhere must deal. But for Pamlico Beach property owners—and others along the state's mainland shores—erosion is literally rapping at their back doors. In fact, East Carolina University scientists studying and mapping erosion in northeastern North Carolina with UNC Sea Grant funding say that erosion lops off an average two to three feet per year along the estuarine shores. In some places it can be more than 10 feet per year, they say.

One way to slow erosion: Pile tons of concrete slabs on river-front banks. Note the tree in the water that used to be on land.



It's nothing new. Mrs. Mary Sawyer, a 58-year resident of Pamlico Beach, pointed a finger toward the Pamlico River. "I can remember when the road was way out yonder. And I used to pick corn where that cottage is," she said, nodding toward a summer home that stands only about 50 yards from the water's edge. The hard-top state road that runs by her mobile home now is the third built since she came here, she said. Today, the River fills the forgotten tracks of the other two.

While they don't like what erosion is doing, those who have lived here most of their lives have accepted it. James Daniels summed up local philosophy about the community's future between swigs of soft drink. "It's like so many things. It'll be gone someday," he said.

Fighting Back

In spite of their acceptance, Pamlico Beach property owners aren't willing to let erosion run roughshod over them. They and newcomers, who soon come to the rude awakening that their lots are slipping into the river, are fighting back—mainly with bulkheads, walls that slow the water's erosive power against the loose bank soils. In the long (See "Scientists," page 3)

The why's and where's of getting permits

Mention erosion in Pamlico Beach and Masceo Daniels will tell you you're talking about a sore

subject.

But it doesn't take long to find out that what really makes Daniels and his neighbors hot under the collar is the red tape a man has to go through to get government permission to protect his land with a bulkhead.

"The government just seems to want to let it all wash away," Daniels said, referring to the land his community perches on. "You can lose 10 to 15 feet while you're waiting to get a permit," he said.

Ed Miller marched to a swatch of his river-front property that jutted out between two eroded coves. Several tons of rock were piled not far from the edge. "I'm afraid to do anything," he said, pointing to the rocks he'd like to use for bulkheading his land. "They (the government) want you to get all kinds of permits," he said.

Miller is right. Both the state and federal governments require that a man have a permit in hand before he excavates or fills his waterfront property. And both state and federal officials agree with Daniels that getting a permit can be a lengthy

process.

Three laws make getting a permit necessary. They are the 1899 Rivers and Harbors Act, the Water Pollution Control Act Amendments of 1972 and the North Carolina dredge and fill law passed in 1969. The 1899 law was enacted to prevent the creation of hazards to navigation. But courts have used the law to cover environmental as well as navigational concerns, according to Dr. Wayne Wright of the U.S. Army Corps of Engineers Wilmington District Office.

Both the 1972 amendments and North Carolina's dredge and fill law were designed to protect habitat of marine species. Both require a permit for filling in any area that is subject to regular or occasional flooding by waters due to anything other than

winds of gale or hurricane force.

Permits protect habitat

For the individual who merely wants to rebuild the few feet of his lot lost to erosion by bulkheading and filling, it might be hard to see how his small action could substantially harm habitat. But according to Wright, permit requirements are aimed

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at regulating and minimizing the total environmental impact of hundreds of individuals who would like to stabilize and restore lands.

The requirement for permits isn't intended to discourage a landowner from protecting his shoreline from erosion. Both state and federal permitting agencies encourage bulkheading and backfilling to protect shorelines—if the intention is simply to stop erosion and not to reclaim large areas of land. State policy is that land can be reclaimed only to the extent lost at the annual erosion rate or no more than has eroded in the past 12 months, according to Jim Brown, chief of the Estuarine

Individuals wishing to bulkhead or dredge and fill in marsh may call on a free consulting service at the N.C. Division of Marine fisheries for planning advice. Call that agency at (919) 726-7021 for details.

Studies Section of the N.C. Division of Marine Fisheries.

Having to get a permit probably wouldn't be so bad if it didn't take so long. North Carolina land owners are saved time by needing to submit only one application for both state and federal permits. But when an application arrives at the N.C. Division of Marine Fisheries in Morehead City, government red tape just begins.

Before state and federal permits arrive in your mailbox, your application is reviewed by a dozen state agencies, almost as many federal agencies, the folks who own land next to yours and others alerted to your plans by a public notice that the

Corps of Engineers issues.

That's why it can easily take months to get the

required permission.

According to Wright, the Corps attempts to expedite all applications within a reasonable amount of time. "We recommend that applicants not expect a permit in less than 60 days," he said, adding that applications out of the routine can take much longer. State permits are usually issued from six to nine weeks after application, according to Brown. But both state and federal permits must be in hand before work can begin.

Provide complete info early

Wright advised that applicants can speed the process by providing complete information from the beginning. "Property owners should plan ahead and apply as soon as plans are complete," he said.

The Division of Marine Fisheries offers North Carolinians a free consulting service to advise on bulkheading and dredge and fill activities. The consultants are available to help potential developers make plans that fit their needs and are likely to be accepted by review agencies. A call for assistance to the Estuarine Studies Section of the Division of Marine Fisheries in Morehead City at (919) 726-7021 could save time and headaches.

Scientists map erosion in northeastern counties

(Continued from page 1)

term, erosion will probably prevail over the treated wood bulkheads and the thousands of tons of concrete slabs, rock, old cars, kitchen sinks, worn-out tires, old fish nets and dead tree stumps people have piled along the waterfront, desperately trying to hang onto their land.

According to ECU geologist Mike O'Connor and biologist Vince Bellis, bulkheading is one way people deal with erosion. Another is to set lot lines back and "let 'er rip," Bellis explained. Both methods have advantages and disadvantages, he

said.



Compare the bulkheaded stretch with that not bulkheaded. Bulkheading holds waters back, slows erosion and saves land. But with bulkheading sandy beaches are lost.

Bulkheading is expensive, now running about \$15 per linear foot. Although erosion behind the wall is slowed, stronger wave action where waves crash into the bulkhead destroys any trace of a sandy beach. By choosing not to bulkhead, you save money and your sandy beach, but erosion will continue its rapid nibbling, according to Bellis.

The secret is planning

The secret to living peaceably with erosion appears to lie in well-thought-out planning that crosses individual lot lines and encompasses stretches of beach that are part of the same "natural unit," the researchers say. According to O'Connor and Bellis, planning should be based on the specific geological and biological characteristics and erosion rates of a particular stretch of shoreline.

But before such planning can take place, information on which shores are eroding rapidly, which are eroding slowly and why they erode at different rates is a must. That is just the kind of information O'Connor, Bellis and Stan Riggs, also an ECU geologist, are seeking in their current Sea Grantsponsored research.

In their study, the scientists are seeking causes, effects and possible solutions to erosion along North Carolina's estuaries. Information on average shoreline erosion in coastal counties is available from a recent USDA Soil Conservation Service study. But average rates provide no insight into what factors govern erosion and how to manage it. And average rates are of little help to the individual whose short stretch of beach may be undergoing more rapid erosion than average figures indicate. To determine erosion for short stretches of shoreline, the researchers are supplementing the SCS information with boat trips to collect first-hand data on geological processes along the state's shores. So far they have covered some 280 miles as they mapped Bertie, Chowan, Washington, Tyrrell and Beaufort County shores.

O'Connor, Bellis and Riggs have found that the mainland shoreline is a series of natural units. Within each, erosion rates are fairly similar, but erosion among neighboring units may vary widely. For example, lands between points A and B may be washing away at five feet per year. But between points B and C, erosion may be taking only one foot annually. The research team, noting differences between the two units, study such factors as vegetative growth, water depth, the lay of the land, current and wave direction and winds to come up with possible explanations for the erosion. A difference in any of these factors could cause

vastly different erosion rates, they say.

A second step in their research is to come up with recommendations on how to best live with and combat erosion in specific areas.

Maps of eroding areas

A third, extremely essential step is to put their findings into a form that county planners and property owners can easily understand and use. Their goal is to provide a series of maps of northeastern North Carolina estuarine shorelines on which even small land owners can locate their property, learn what forces are acting upon it and determine the likely annual erosion rate.

Eventually scientists hope to provide similar (See "A series," page 4)

ECU scientists studying erosion in northeastern North Carolina are putting their findings into a series of maps for property owners. The maps will show how fast your land is eroding, why it erodes as it does and what you might do to live with it at least expense over the long-term.

Workshops on insect control set for November



Sand fly or biting gnat

Fall sessions of the Training Course in Mosquito and Biting Fly Control begun last spring will be held as follows:

November 5-6 —New Hanover County Health Department, 2029

S. 17th Street, Wilmington; November 12-13—Carteret Marine Resources Center, Bridge Street, Pine Knoll Shores;

November 19-20—Dare County Administrative Building, Manteo. Beginning at 9 a.m. and adjourning around 3:30 p.m. daily, the fall sessions will expand on material covered in the spring training courses.

Emphasis will be on mosquito survey, identification and biology, ULV chemical control and equipment maintenance and control of

mosquito larvae with chemicals and other methods.

Insect pest control operators who participated in spring workshops are urged to return for the fall sessions, conducted by North Carolina State University entomologists. Sponsors of the training course are UNC Sea Grant and the N.C. Agricultural Experiment Station in cooperation with the N.C. Department of Human Resources.

For further information, contact:

Dr. J. C. Dukes NCSU-Entomology c/o UNC Marine Sciences Institute North Carolina State University Morehead City, N.C. 28557 726-6841

Dr. R. C. Axtell Dept. of Entomology Raleigh, N.C. 27607 737-2832

A series of maps to help property owners

(Continued from page 3)

maps for other sections of North Carolina. But before such maps can be compiled, county officials and citizens may be able to use information gathered in the state's northeast section. According to the researchers, many shoreline areas from Virginia to South Carolina have similar characteristics and problems which can be dealt with in similar ways.

So how might a man like Ed Miller benefit from the maps O'Connor, Bellis and Riggs are prepar-

ing? Simply, the maps will supply him with information he needs for planning how he will use his land in the future. When he sees at a glance what areas are eroding rapidly and why, he will be able to make sound decisions on whether to invest further in his property for one use or another. And because the maps will show what's happening erosion-wise in a "natural unit," he'll be able to work with his neighbors in developing a sound plan for living with erosion.

University of North Carolina Sea Grant Program 1235 Burlington Laboratories North Carolina State University Raleigh, N.C. 27607



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University of North Carolina Sea Grant Program

NEWSLETTER

NOVEMBER, 1975

1235 Burlington Laboratories NCSU, Raleigh, N.C. 27607 Tel: (919) 737-2454

More mileage from our resources

We'd like to have our cake and eat it too.

We want an environment rich in raw materials, clean air and water, lush foods and eyepleasing scenery. But our mouths water for resources that nourish a richer life.

We realize that use sometimes turns to abuse. And with some resources getting short, we want to get the most mileage from our lands, water, minerals and wildlife.

University scientists whose work is supported by the UNC Sea Grant Program are looking for ways to stretch the mileage we get from coastal resources. They are seeking knowledge that will enable us to continue getting fat on the earth's bounty without being unwise and wasteful. Ultimately they hope their findings will someday help improve the economic and environmental quality of life for people in the coastal zone.

This newsletter describes the projects UNC Sea Grant-supported researchers at N.C. State University, East Carolina University, UNC at Wilmington and Chapel Hill will do during 1976 to provide information needed for making the most of our unique resources in coastal North Carolina.



Counterattacking shellfish viruses

Put one first grader with measles in with 30 others and you're likely to get a room full of redsplotched faces.

Shrimp and crab don't get measles. But they are subject to many diseases that spread at least as fast as measles among first graders. Disease can present real problems for anyone trying to culture shellfish in a confined area. An entire population can be quickly wiped out if a fatal disease invades a culture tank.

Biologist Charles Bland has been a pioneer in identifying and controlling fungal diseases of blue crab and shrimp in aquaculture. But his Sea Grant supported research is of little use if it never gets beyond the door of his East Carolina University lab. That's why his goal for 1976 is to get his findings into a form that anyone who farms shellfish can use to identify and treat disease. He plans to develop two handbooks. One will describe fungi affecting shellfish and provide keys to identifying disease. The other will focus on diagnosing and controlling shellfish diseases caused by fungi. Meanwhile Bland will continue building on his knowledge through continued study of the biology of shrimp fungi and chemical and biological control methods.



Local governments in coastal North Carolina are in the midst of drawing up plans for how their lands will be used in the future. Sea Grant research projects aimed at bringing together information useful in managing coastal lands should be helpful to planners.

citizens and local officials.

UNC law professor Tom Schoenbaum is taking a legal look at how counties and municipalities put plans for land use outside of "areas of environmental concern" into effect. Development within those specially-designated environmentally sensitive areas will be regulated by a permit system, administered by the counties and state. But it will be up to the counties to implement land use plans outside of "areas of environmental concern." From his study Schoenbaum will make recommendations on the legal tools governments can use to implement planning. Schoenbaum will also look at how government red tape can be reduced and other problems relating to the legalities of planning.

A study that got underway in August and will continue through June promises to provide a handy tool for formulating development policy that reflects the ecological characteristics of different types of coastal environments. A handbook for the non-scientist, a major product of the study, will describe and provide scientific information on ecological processes at work in various types of shore environments. It will also describe alternative development policies that are compatible with specific environments. Policies to be described in the book will take ecological processes into consideration. Led by David Brower of UNC-Chapel Hill's Center for Urban and Regional Studies, the project brings together expertise from marine science, law and planning.

In their ongoing research, ECU scientists Mike O'Connor, Vince Bellis and Stan Riggs will map shoreline erosion along the estuarine shores of counties in the eastern Albemarle and southeastern Pamlico regions. From their maps, small property owners will be able to determine the approximate rate of shoreline erosion on their land, geologic and biologic processes influencing erosion and alter-

native methods for coping with shoreline erosion.

Research that is already providing data useful in managing the state's coastal waterbirds will be further developed by biologists Jim Parnell and Bob Soots of UNC-Wilmington and Campbell College. Census techniques developed by the researchers in 1975 will be used. A count of the number of birds today will be useful for future comparisons to determine the changing status of bird populations.

Ernie Seneca and Steve Broome, NCSU botanist and soil scientist, are developing further know-how for creating new marsh with plantings of marsh grasses on dredge spoil. During the year, they'll also keep an eye on the growth of mixed beach grasses they planted in

earlier years to stabilize dunes.

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A network operating between you and the lab

A lot of research findings never get beyond the laboratory door. But through a network of advisory services agents, most of whom live and work on the coast, findings from Sea Grant and other marine research programs are taken from the lab to people who can use and benefit from them. In turn, advisory agents help keep Sea Grant in tune with the real needs of coastal citizens by relating problems they see and hear to program organizers.

During 1976, UNC Sea Grant will continue its wide-ranging advisory work and will add a specialist to assist coastal recreation industries. Jim McGee, Sumner Midgett and Hughes Tillett will keep working with commercial fishermen, updating them on equipment and methods, business management and new

kinds of fishing.

Ted Miller, Dave Hill, Frank Thomas and Skipper Crow will maintain close contact with finfish and crab processors seeking to upgrade product quality and meet government standards.

Walt Jones, John Foster and Bill Rickards will develop and disseminate information on how to farm eels in enclosed ponds at their New Bern eel demonstra-

tion unit.

Land-use advisory agent Simon Baker will be available to assist local and state governments in developing land-use plans and to provide information to make their planning more complete. A directory of aerial photography for 44 eastern North Carolina counties which Baker is compiling should prove a useful tool for counties and municipalities engaged in landuse planning.

Untangling the salt marsh food web

Laws regulating man's activities in marshlands were passed as we began to realize that the push to develop marsh might be destroying an essential food

source for many kinds of fish.

Just how important marsh grasses are to fish production needs further study if we are to make sound decisions on man's activities inside and on the fringe of marsh. Two Sea Grant projects for 1976 should help fill the gaps in our knowledge about the transfer of food energy within marsh and from marsh to open estuaries.

UNC ecologists Allen Stiven and Ed Kuenzler are looking at the relationship between decaying marsh grass particles (detritus) and small marsh animals. A major goal is to determine if man, by manipulating the marsh grass grown and detritus produced, could influence fish

productivity.

John Hobbie, NCSU ecologist, is examining the role of bacteria and other microbes which attach to and break down marsh grasses in the diet of marsh organisms. Study results should shed light on the importance of protein-rich bacteria in the salt marsh food web.

Toward better seafoods from Tarheel waters

Improved seafood quality and a bigger chunk of the seafood dollar for North Carolina are the goals

of several Sea Grant projects in 1976.

Mark Sobsey of the UNC School of Public Health is seeking improved methods for detecting viruses harmful to humans found in clams and oysters and the waters where they grow. Some 700,000 acres of the state's shellfishing grounds have been closed because waters do not meet quality standards which are based on bacteria counts. Sobsey be lieves that coliform bacteria counts provide less than an adequate picture of viruses in shellfish waters. His goal is to come up with more sensitive, reliable and practical ways to determine quantities of harmful viruses in shellfish and their estuarine habitats.

NCSU food scientists Neil Webb, Frank Thomas and Ted Miller will continue analyzing the properties of deboned fish meat to gain information important in developing new products using the minced tissue. A related project which seeks to pinpoint areas in crab meat processing which contribute to sanitation problems promises to help crab processors meet new, more stringent quality

Should we depend on the ocean?

Coastal county and town officials faced with disposing of increasing amounts of sewage are looking at each other and asking, "Where do we go from here?" With a finger pointed to crowded septic tanks and municipal sewage plants as a major pollution source forcing nearly 700,000 acres of the state's shellfishing grounds closed, many are looking to the ocean for a solution.

Some states have already built ocean outfalls, sewage pipelines into the sea. Some have found them suitable. Others, where currents have washed effluents back to shore, have found outfalls less

than the perfect answer.

Drs. L. J. Pietrafesa and C. C. Tung, NCSU oceanographer and ocean engineer, have Sea Grant support to find out if ocean outfalls built off the state's fast-growing southeastern corner into Onslow Bay would work. Plans in 1976 are to continue measuring physical characteristics, waves, current, wind, salinity, temperature and other factors that determine where things dumped in the ocean are likely to go and how fast they will travel.

As measurements are made over the seasons and throughout the Bay, data will be fed into a computer. It will be up to the computer to predict the pathways effluents dumped in Onslow Bay might take.

Information from this research is critical as the state develops policies on ocean outfalls. Other agencies such as those regulating water pollution and power plant and superport construction should also find the results useful.



requirements. Researchers will also examine the effects of processing on crab meat quality and storage time. A series of publications is planned to relate findings to the industry.

Marvin Speck of the NCSU food science department is seeking better methods of detecting diseasecausing bacteria in seafoods. Improved detection

(See page 4)

Panel reviews 1976 UNC Sea Grant projects

Twenty-six projects proposed by the UNC Sea Grant Program for 1976 were reviewed September 30 and October 1 by a panel of marine scientists and specialists from federal agencies, universities and the private sector. This year's site visit was

held at Atlantic Beach.

Now approaching its sixth year in North Carolina, the Sea Grant Program proposed coastal and marine research and advisory services projects totaling \$985,600. Funds for Sea Grant are awarded by the U.S. Commerce Department's National Oceanic and Atmospheric Administration (NOAA) and matched by the N.C. Department of Administration. Federal funds make up 67 per cent of the program budget. Approved funding will be announced later.

In opening remarks Dr. E. Walton Jones, UNC associate vice president for research and public service programs, welcomed the site panel and spoke to the University's interest in an ongoing Sea Grant Program. Dr. Ernie Carl, director of the N.C. Office of Marine Affairs, expressed the state's support for a Sea Grant Program directed to pressing needs in the coastal area.

N.C. Secretary of Administration Bruce Lentz, in after-dinner remarks, reiterated the state's support for Sea Grant. But, he said, in a time of tough

budget decisions, Sea Grant must address top priority problems in the coastal zone to provide much-needed information for management decisions on state and local levels.

Members of the panel were David B. Duane, associate program director, National Sea Grant Office; William N. Shaw, assistant program manager, NOAA Marine Advisory Service; Donald H. Rosenberg, director, Alaska Sea Grant Program; James H. Wakelin Jr., Research Analysis Corporation; Ted Rice, director, Atlantic Estuarine Fisheries Center, Beaufort; Daniel A. Hunt, U.S. Food and Drug Administration; C. J. Kirby, U.S. Army Waterways Experiment Station; Robert Baker, Cornell University Institute of Food Science and Marketing; George Benton, Johns Hopkins University; and Abram Bernstein, National Advisory Committee on Oceans and the Atmosphere.

Representing the four UNC campuses in the Sea Grant Program were acting chancellor Jackson A. Rigney, N.C. State University; Robert Holt, vice-chancellor and dean, East Carolina University; Dirk Frankenberg, director of marine sciences at UNC-Chapel Hill and Charles Cahill, vice-

chancellor, UNC-Wilimington.

Toward better seafoods

(Continued from page 3)

methods should help processors and food safety analysts carry out more effective processing sanitation programs. Another phase of the study will examine the value of coliform bacteria as an indicator of disease-carrying bacteria in seafood.

NCSU food scientist George Giddings will collect data on nutrients and chemical contaminants in North Carolina seafoods and will seek to determine how processing changes levels of nutrients and contaminants. Such information should help assure the safety and optimal nutritional value of processed seafoods.

Upcoming conferences

Energy from the Oceans: Fact or Fantasy. January 27-28. Hilton Inn, Raleigh, N.C. Sponsored by UNC Sea Grant, Coastal Plains Center for Marine Development Services and the NCSU Center for Marine and Coastal Studies. Contact UNC Sea Grant for more information.

Annual Conference on Marine Resources in the Coastal Plains States. December 11-12. DeSoto Hilton Hotel, Savannah, Ga. Sponsored by the Coastal Plains Center for Marine Development Services, Wilmington, N.C. in cooperation with Virginia, North Carolina, South Carolina, Georgia and Florida. Contact Phil Hill at the Center at (919) 791-6432 for further information.

University of North Carolina Sea Grant Program 1235 Burlington Laboratories North Carolina State University Raleigh, N.C. 27607



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University of North Carolina Sea Grant Program

NEWSLETTER

DECEMBER, 1975

1235 Burlington Laboratories NCSU, Raleigh, N.C. 27607 Tel: (919) 737-2454

What do you want for your county's future? Heavy development? No development? Something in between?





Robert N. Elliott

On coastal land use:

It's time to speak up

A lot of folks these days are saying that government has gotten too big. The individual, some would tell you, just doesn't have much say about how things are run anymore.

That may be true in some places and some aspects of life. But in coastal North Carolina, the individual is getting his chance. In fact, in the next few months, he can voice views that could shape the future of his county and the quality of life for years to come.

Coastal citizens will have a chance to speak out on whether their town or county should keep a rural atmosphere, whether lands should be used for factories and how many people they think should eventually live in their area.

When they give their views on these and other questions, coastal residents will be participating in land use planning or coastal area management. That sounds pretty complicated. But simply put, it's sitting down today and deciding what you want your town or county to be like tomorrow. And it's basing those decisions on the ability of the area's natural resources to support growth.

Planning in the state's coastal counties got underway months ago and already citizens have played a vital role. The state legislature

(See "It's," page 3)



Keeping nature's forces in mind can help you avoid this.

Coping with coastal environments

OK. So you've scraped and saved and finally you've got the money to buy that second home, the one you always wanted down at the beach.

You rush out to buy a house with the right number of bedrooms, a large kitchen and all the other interior features your family wants and can afford.

But what about outside? Sure you look at the garage and the driveway and you know the exact dimensions of your lot.

But what about the natural forces huffing and puffing at your door? Sometimes developers develop and buyers buy without really considering how nature is acting on a particular spot. By knowing something about natural forces—like tides, winds and plants—which daily shape coastal lands, you might be able to avoid the heartache of seeing nature cash in on your investment.

Right now a UNC Sea Grant team is putting together a handbook that should help you understand and work in harmony with these natural forces.

This is how the handbook might help you.

Say your land had a dune in its southeastern corner. You want to build on your land, but you've heard that dunes move. From the handbook, you could learn what forces are acting on dunes, the direction they normally migrate and how fast they move. Answers to these questions should help you determine if your development plans conflict with nature's forces. The book will also give you information to help you live with a marsh, an estuary, inlets and other coastal features.

Another section will explore the impact of making physical changes in different types of coastal environments. You could learn, for instance, what happens when seawalls are built in front of dunes

or what effects filling a marsh may have.

Along with this kind of information, the handbook will describe policies which local governments could use to guide where development occurs. Policies included in the book will be based on the unique set of natural forces acting and interacting on particular types of environments or "habitats."

The handbook, which doesn't have a name yet, is expected out next summer. It draws on the talents of marine scientists who have researched the natural forces of the coastal environment and lawyers and planners who have expertise in policy areas. David Brower of UNC-Chapel Hill's Center for Urban and Regional Studies is leading the project.

The University of North Carolina Sea Grant Program Newsletter is published monthly by the University of North Carolina Sea Grant Program, 1235 Burlington Laboratories, Yarbrough Drive, North Carolina State University, Raleigh, N.C. 27607. Vol. 2, No. 12. December, 1975. Dr. B. J. Copeland, director. Dixie Berg, editor. Second-class postage paid at Raleigh, N.C. 27611.

Air photos are useful planning tool

From the ground, it's tough to see the forest for the trees. But from the air, you can see the forest—and much more. You can trace rivers, see where large numbers of trees have been cut, where houses are built and what borders on the forest's edge.

By teaming up camera with airplane, you can capture all kinds of information about the forest in a mere fraction of a second. Besides giving you a quick picture of what's going on in the forest, air photos taken today and compared with next year's tell you in a glance how things are changing.

Developers and planners often need the kind of overview aerial photographs provide. Many are already finding them a useful

planning tool.

To help North Carolina's coastal county planners and developers make better use of aerial photos, UNC Sea Grant advisory services agent Simon Baker is compiling a directory of existing aerial photographs covering 44 eastern North Carolina counties. The directory, which he expects out by spring, will include a section on how to use aerial photography in landuse planning and will explain procedures for ordering the imagery, much of which dates back many years, he said.

Baker himself is using a set of aerial photographs taken in 1974 by the N. C. Department of Transportation in a study of land-use on the Outer Banks. Baker's analysis of the 1974 photos should provide a handy base for detecting trends in uses of the barrier islands.

According to the Sea Grant advisory agent, aerial photos from the past allow us to see how lands have been used and how they came to be used as they are today. Such information is useful in planning for the future, he said.

It's a question of what you want your area to be like tomorrow

(Continued from page 1)

passed the Coastal Area Management Act in April, 1974. Since July of last year, counties and municipalities, aided by their citizens, have worked to draw up local land use plans which the law requires. In brief, the plans identify the major land use issues facing an area and set forth objectives to help guide future growth based on current land uses and the ability of natural resources to support different types of development.

On November 23, those local plans were submitted to the Coastal Resources Commission (CRC), the state agency charged with implementing the Act, for review. In January, the CRC will return the plans for another round of citizen review. Local governments must adopt their plans by May 21 and return them to the CRC for the final approval that is needed before they are put into effect.

Whether a plan is approved depends largely on how much citizen participation goes into them. So between January and May, your

voice will count.

Sure, you say. They want me to get involved. But how? I don't understand all those high-falutin' words that planners and government types use, you tell yourself. If I don't understand, how can I speak out?

The people in charge of getting coastal management rolling know how you feel. And they're trying to help you get on the inside of the

planning process.

Under guidelines of the CRC, local governments are to write a synopsis, or summary, of their land use plans in non-technical lan-

guage. It is to be distributed widely among local citizens.

The synopsis will give you an overview of land use problems that are important in your county or town. It will state the goals and objectives for future land use in your area and tell you how and why those goals were determined. From the synopsis, you'll be able to learn how lands came to be used as they are and how much development available natural resources can tolerate without being threatened. You'll be given information on how population growth in your area might put new demands on services like water and sewer.

Along with the synopsis will be a list of proposed areas of environmental concern, areas in which development should be carefully watched in order to conserve resources. An accompanying map of your county or town will indicate which lands will be used for high or low density development, which will be maintained for rural activities such as farming and which should be conserved for their environmental value or because development there would be unsafe.

If you don't get a copy of your local government's synopsis, or if you disagree with what you find in it, you should get on the phone to your county or town planning board. In some areas citizen advisory committees have been set up. These are another channel for your thoughts. And any questions—or answers—about the Coastal Area Management Act or land use planning will be heard if you call The Coast Line collect at (919) 829-2293 during business hours.

During the coming months, there will be opportunities to find out what's happening in the state's coastal zone, to have a part in shaping its future. But it's up to the individual to get informed and get involved. It's a chance for the individual to turn the tables and tell his government how to run things. Look for a synopsis, or summary, of your town's or county's land use plan during January and February. In non-technical language, it will tell you about land use problems that are important in your area and will state goals for land use. It will explain how these goals were determined.

The synopsis isn't final. You have until mid-May to make your thoughts on the plan known. It's a good chance to have a voice in your future.

If you don't see the synopsis and if you have something to say about it—whether in agreement or disagreement—let your county planning board know. Or call The Coast Line at (919) 829-2293 collect during office hours.

Energy from the ocean: fact or fantasy?

Is it fact or mere fantasy that the oceans will furnish tomorrow's energy?

A conference on energy from the oceans, set for Jan. 27-28 in Raleigh, will bring together some of the world's leading experts on ocean energy research to answer this and more specific questions

on ocean energy sources.

Dr. R. Cohen of the Energy Research and Development Administration will present an overview of ocean energy research and the U.S. Energy

from the Ocean Program.

Speakers, including W. E. Heronemus of the University of Massachusetts and S. H. Salter of the University of Edinburgh, will discuss the potential of energy from the seas' winds and waves. Other speakers will explore the possibilities and problems of capturing energy generated by differences in ocean temperatures, known as ocean thermal energy.

Legal, political and environmental aspects of using oceans for thermal energy production will be the topic of a morning session during the meeting's second day. Other sessions will address the problems of transporting ocean-produced energy to inland users and the possibilities of ocean thermal power plants off the nation's southeast coast.

The conference should be of interest to government, university and industry representatives engaged in ocean and energy programs as well as any support agencies and industries such as electric utilities, shipbuilding firms and environmental consultants. Sponsors include the UNC Sea Grant Program, the Coastal Plains Center for Marine Development Services, the NCSU Center for Marine and Coastal Studies and the Division of Continuing Education.

Hotel reservations should be made directly with the Hilton Inn, Hillsborough Street, Raleigh, N.C. 27607. A \$35 registration fee should be paid to the Division of Continuing Education, P.O. Box 5125, N. C. S. U., Raleigh, N.C. 27607. Attention: John

B. Gordon.

University of North Carolina Sea Grant Program 1235 Burlington Laboratories North Carolina State University Raleigh, N.C. 27607



Do some need special care?

Some people believe that some of our coastal lands and waters need special care.

The state's Coastal Area Management Act reflects their belief. It says that some parts of the coast are to be designated "areas of environmental concern" (AECs). In areas that are so designated, man's activities will be more closely guided to insure that we not destroy these resources.

Before we can make sound decisions on what lands and waters are named AECs, we need to know why they may be worth special treatment or why it may be unsafe

to use them.

Coastal Development and Areas of Environmental Concern, UNC Sea Grant Publication 75-18, explains why some people think some areas are important enough to be AECs. Most of those who contributed to the publication, and to the spring symposium from which it is compiled, are scientists who have studied marsh, dunes, estuaries and historic and archaeological sites. Their thoughts are based on years of research which here is summed up in language the non-scientist can understand.

Tying in with the publication, which was edited by Simon Baker of the UNC Sea Grant advisory services program, is a film which will discuss the importance of dunes, estuaries and marsh. Under production by Les Thornbury, N. C. State University landscape architecture student, the film should be available for viewing by clubs, civic organizations, school groups and at public gatherings by February 1.

Both the film and the publication are designed to provide the citizen with information needed to make sound decisions about how his lands will be used in the

future.

To order Coastal Development and Areas of Environmental Concern, write the UNC Sea Grant Program Office.

Second-class postage paid at Raleigh N.C. 27611



UNIVERSITY OF NORTH CAROLINA STATE LIBRAR

SEA GRANT PROGRAM NEWSLETTER

JANUARY, 1976

1235 Burlington Laboratories NCSU, Raleigh, N.C. 27607 Tel; (919) 737-2454



Victor Salter's office isn't what you might expect, considering that he presides over the books of a million dollar business. Where you might expect dark walnut paneling are lime green cinderblocks. And where you'd expect to plant your foot on lush shag carpet, you find cold tile.

But then, the business that Salter manages doesn't live up to some other expectations either. It doesn't produce socks or sofas, like you might guess a North Carolina industry would. And if you guessed that this million dollar enterprise, which in 1975 grossed some \$2.5 million, had been decades in the making, you'd be wrong.

It's been a brief five years now since Bill Lambert, retired from the lumber business with almost no knowledge of the fishing industry, bought a small trawler on the North Carolina coast. That trawler was the seed that blossomed into Southern

Seafood Co., today the nation's largest scallop processing company, located in the Carteret County countryside.

Beyond the pastel walls of Salter's office is an operation that makes you want to kick yourself and ask, "Why didn't I think of that?" With a lot of ingenuity and a knack for improving on what's been done before—and a patent to show for some of the equipment he's designed—Lambert has made the job of shucking scallops look easy and fastmoving.

In fact, the maze of conveyors, washers, rollers, screens and the plant's 25 employees can process up to 1,000 gallons, that's 8,000 pounds of ready-to-cook scallops in one day. By hand, shucking that many would require 300 workers. When you hear that scallops have recently sold for up to \$18 per

(See "Processors," p. 3)

A service for big and small seafood processors

Seafood processors:

If you've got a problem understanding or complying with regulations on effluent discharge, contact the following people. They will provide assistance or help you contact someone who can.

Clark Callaway or Ted Miller P.O. Box 51 Morehead City, N.C. 28557 (919) 726-7341 Maybe you never thought of yourself as a "seafood processor." Sure, you head a few shrimp and sell them to your neighbors during season, but you'd never call yourself a "seafood processor."

But in the government's eye, you are just that, especially if you get rid of shrimp heads or other wastes by tossing them back into the water.

The same rules that make it illegal for big processors to put tons of shrimp heads and other wastes into the water apply to you no matter how small. Like the big boys, you've got to get a permit that tells you just how much waste you can dispose in the river, sound or ocean.

The government also says that whether you're big or small, you've got to treat or "clean-up" wastes before they're released into any body of navigable water. Treating simply means removing organisms or chemicals from wastes that might be harmful to the environment.

You've got until July, 1977 to be using the best practical means of treating wastes, the government says. By 1983, you should have the best methods available to remove pollutants from wastes.

If you're like a lot of other folks, you're probably not sure what all that means. But whatever, you figure it rings of money. And because you're only a part-time processor, you reckon it's probably going to cost more than you can afford.

But don't despair.

There are folks around who want to help you understand what the new regulations mean and how you can comply. Their assistance is for all processors, big and small.

Clark Callaway and Ted Miller at the Sea Grant Seafood Laboratory in Morehead City and Frank Thomas, seafood advisory services specialist at N.C. State University in Raleigh, are the folks to know if you need assistance in understanding or complying with the regulations. Roy Carawan, an NCSU food engineering extension specialist, is assisting them.

None of them claim to have all the answers. But by working with the industry, they hope to learn. Since their work, supported by the Coastal Plains Regional Commission and UNC Sea Grant, began in September, they've focused on scallop processing. Other kinds of seafood processing—finfish, blue crab, clams, oysters, shrimp, and fish and crab meal—will get their attention during the next two years.

By giving Callaway, Miller and Thomas your opinions and showing them your problems, you could have a voice in shaping government guidelines for treating plant discharge. Through Sea Grant and agriculture extension agents, seafood trade associations and state agencies involved in the seafood industry, your voice may be heard during hearings on the guidelines as they undergo revision.

Callaway, Miller and Thomas will continue working with Tarheel processing plants to collect data needed to assist in complying with the new discharge controls. In studies at the plants, they'll collect samples to take to the lab for analysis of the kinds and quantities of pollutants the samples contain. And they'll look at how seafood processing plants are laid out to determine if some small change, or the addition of a small piece of equipment, could reduce the amount of water used and the amount of discharge produced.

With this information, they will meet individually or in groups with processors to suggest helpful changes. Through these meetings and through informational materials, Callaway, Thomas and Miller will be seeing that all processors—big and small—get the assistance they need to live up to the spirit of the new law.

The University of North Carolina Sea Grant Program Newsletter is published monthly by the University of North Carolina Sea Grant Program, 1235 Burlington Laboratories, Yarborough Drive, North Carolina State University, Raleigh, N.C. 27607. Vol. 3, No. 1, January, 1976. Dr. B. J. Copeland, director. Dixie Berg, editor. Second-class postage paid at Raleigh, N.C. 27611.

Processors...

(Continued from page 1)

gallon, you'll really want to give yourself a kick.

But building a plant such as this hasn't been without obstacles. Elmer Willis of Williston worked out a large portion of scallop processing's problems in the late 60s with his invention of the mechanical shucker. But maintaining steady supplies of raw scallops, mechanizing and marketing are ongoing hassles. Still others loom ahead for Lambert and other seafood processors.

Complying with what seems an ever-increasing list of government regulations has become a major stumper. Heavy on some processors' minds are regulations which place strict limits on how much waste processors dump in the nation's waters. These regulations, growing out of the Water Pollution Control Act Amendments of 1972, are aimed at eliminating discharge of harmful wastes and pollutants into the nation's waters by 1985. They will affect all seafood processors who use rivers, sounds, creeks or the ocean as dumping grounds for their wastes.

Under regulations established by the 1972 Amendments, seafood processors (and all other industries or individuals) who discharge pollutants into the nation's navigable waters must get a permit. The permit tells its holder how much waste he or she can put into waters per day or week and how concentrated in harmful pollutants it may be. It may also spell out a schedule of monitoring, or measuring, discharged wastes which the permitholder must carry out. In North Carolina, the Department of Natural and Economic Resources' Division of Environmental Management issues permits.



Shells are only part of the waste at a scallop plant. Humans eat only about half of a scallop's flesh. The baffler is how to get rid of the other half without polluting water supplies.

Realizing that old methods can't be changed overnight, authors of the regulations allowed time for adjustment. Guidelines for treating effluents, or wastes, say that processors must be using the best practical treatment technology by July, 1977 and the best available technology by July, 1983.

More specific guidelines on treatment of effluents are undergoing continual revision. According to Frank B. Thomas, UNC Sea Grant seafood advisory services specialist, processors can have input into revised guidelines.

Sea Grant seafood advisory agents, agricultural extension agents, seafood-related trade associations and state agencies working closely with the seafood industry have and will continue to participate in hearings on the guidelines, Thomas said. Processors can have input into the final regulations by passing their thoughts and needs on to these people and organizations.

Regulations controlling waste disposal have caused fears that the expense of new equipment

Guidelines for treating effluents, or wastes, require that seafood processors be using the best practical means of treatment by July, 1977 and the best available treatment technology by July, 1983.

and revamping old ways could put a large number of North Carolina's 610 processing establishments out of business. Since many are small, family-owned ventures that operate only part of the year, the cost of meeting the requirements could financially wipe them out, some fear.

Joey Hill, environmental engineer in NER's Wilmington office, says his agency, the one charged with seeing that seafood processors live up to the law's requirements, isn't trying to put processors out of business. "We're trying to help by showing them what needs to be done under the law," he said. "We're glad to meet with them to discuss how to comply."

Some processors apparently don't intend to let government regulations interfere with business. A few are already taking the bull by the horns.

"I think they (the new regulations) are good," Salter said, adding that he was pleased with the assistance his plant had gotten from Sea Grant advisory agents Clark Callaway and Ted Miller. With their advisory help, Southern Seafood has tried disposing of wastes in a landfill near the plant. While all the kinks aren't yet worked out, Salter pointed to one benefit of on-land disposal. "Corn we planted (on a landfill area) burst out of its husks," he said. "And we had a 17 foot high sunflower."

Who knows, with more experiments, industry and researchers may hit on ways to put seafood wastes to good use.

Food scientists looking at good and bad effects of processing seafoods

When it comes to seafood processors, government agencies aren't just interested in what goes out the drain pipe. They're also concerned about what goes into the final seafood product, especially if it's shellfish, a product which seems especially

prone to contamination.

Heavy metals, like copper, cadmium and mercury, are thought to be a major shellfish contaminant. But to date, it hasn't been determined exactly how much heavy metal blue crabs, oysters, clams and scallops contain, either before or after they are processed. No one has yet determined how much these contaminants increase or decrease during processing.

Likewise, little is known about how the number of disease-producing bacteria and viruses and the nutritional values of shellfish are affected by pro-

essing.

Dr. George Giddings and Dr. Marvin L. Speck, N.C. State University food scientists, are seeking

to fill the gaps.

With UNC Sea Grant support beginning this month, Giddings will build on data he collected in scallop plants last year under a UNC Marine Science Council grant. He plans to survey clam, oyster and blue crab plants in the coming year.

Specifically he is looking to see what effect different aspects of processing have on levels of heavy

metals and nutrients in shellfish.

Speck is concentrating on finding methods for detecting disease-producing bacteria and viruses in raw and processed seafoods. Part of his work is aimed at finding how harmful microbes find their way into seafoods, where they come from and what alterations might be made in processing to reduce them.

With this information, Giddings and Speck will be able to make recommendations on how processors might make changes in their operations to reduce heavy metals and harmful microorganisms and to conserve nutrients. In addition, their data will be useful to agencies such as the federal Food and Drug Administration which is intent on safe-guarding consumers from hazardous substances in fish and shellfish.

Books and movies

Following is a list of publications recently produced by UNC Sea Grant. Order yours by writing: UNC Sea Grant, 1235 Burlington Labs, N.C. State University, Raleigh, N.C. 27607.

The Case of the Slippery Eel or How to Harvest, Handle and Market Wild Eels. Berg, D. R., W. R. Jones and G. L. Crow. UNC-SG-75-20.

Coastal Development and Areas of Environmental Concern. Baker, S. UNC-SG-75-18.

Flow Dynamics of the Neuse River Estuary.

Knowles, C. E. UNC-SG-75-16.

Hydrology and Circulation Patterns in the Vicinity of Oregon Inlet and Roanoke Island, N.C. Singer, J. J. and C. E. Knowles. UNC-SG-75-15.

Development of Seafood Patties Utilizing Mechanically Separated Fish Tissue. Webb, N. B.

and F. B. Thomas. UNC-SG-75-03.

Wood-Boat Maintenance: Decay and Its Prevention. Produced by Oregon State University Extension Service and Sea Grant Marine Advisory Program. Available from UNC Sea Grant.

The Currituck Film. 16 mm color film, 23 minutes. Describes Currituck County's plan for

controlling growth.

Waterbound: Our Changing Outer Banks. 16 mm color film, 21 minutes. Concerns erosion and other coastal geologic forces and how man deals with them.

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UNIVERSITY OF NORTH CAROLINA

SEA GRANT PROGRAM NEWSLETTER

FEBRUARY, 1976

1235 Burlington Laboratories NCSU, Raleigh, N. C. 27607 Tel: (919) 737-2454



Fishing

Yesterday, Today...

It's been a long time coming, but fishing—one of our nation's first industries—has finally left the days of the colonists and entered the twentieth century. The road has been a long one, and there are more miles yet to travel:

Under the smooth skin of Lawrence Austin's hands are bones gnarled by 81 years of life and 55 years of fishing. Despite their age (and perhaps thanks to the hard work), Austin's hands are steady and strong enough to tie up a bag of potatoes on the back porch to keep bugs out the way Austin womenfolk used to do.

And just as Lawrence Austin's hands are still alive, so is his mind alive with memories of fishing in "back days." There was the time, in 1917, when the Pamlico Sound froze over from shore to shore; and the time, the year slips his mind, when motors for fishing boats first came to North Carolina's Outer Banks around Hatteras.

(See "Progress Hasn't," page 2)

... And Tomorrow

Yesterday's fisherman knew the meaning of hard work. He didn't have many gadgets to help him do his job. But the fish were there. They were his if he worked to get them.

Tomorrow's fisherman probably won't know the kind of grueling labor his grandfather knew. Machines will have taken over a lot of the back-cracking work.

Trouble is, tomorrow the fish might not be there. Some species have been so over-fished that their number are already seriously low. A fisherman faced with a shortage of fish is a worried man—especially if he's paying off loans and trying to eke out a living too.

Demand for fish has increased dramatically over the past three decades. From 1950 to 1970, the world catch jumped from an estimated 46 billion pounds to 153 billion pounds. Foreign fishing has accounted for most of the increase, since

(See "As Fishing," page 4)



Lawrence Austin:
"We had it the hard way . . .
They don't work anymore."

'Progress' Hasn't

(Continued from page 1)

Fishing was rough, often dangerous, and the hours were long—especially for two young brothers courting the ladies, too. Equipment was basic. Boats were often made on the island. Fishermen made their own sails. And Austin says "The whole family would tie on a net."

Manila net ropes had to be weighted with leads or five-pound bricks, or floated with cork. And nets had to be tarred—every two weeks in summer—to prevent rot. Tarring was a tedious job involving steaming caldrons, tar-heavy nets and flats for drying.

"We had to fish," Austin says, "or leave home.
... We had it the hard way," in what he nonetheless calls "the good old days." But today, he grins, "They don't work any more."

Of Men And Machines

Bill Foster disagrees with Lawrence Austin about that. Foster, 32, is a doctoral candidate in fisheries biology from N.C. State University who decided some years back that he'd just as soon catch fish as study them. Foster lives with his wife and children in a modest frame house in Hatteras down the road from the trim house Lawrence Austin built for his bride.

Fishing has come a long way since Austin's back days: Foster, a Floridian who only fished for sport previously, uses durable synthetic nets and ropes. The ropes have built-in floating and sinking properties, so cumbersome weights and floats are unnecessary. Foster's 30-foot open boat is, of course, motorized and can carry about four times as much weight as similar motorless boats in Austin's day could. Foster uses a citizen's band radio to keep in touch with other boats and shore.

And he plans to buy an hydraulic system—a device that can "take the work out of fishing" by automatically reeling in a loaded net—and a fathometer to keep up with schools of fish.

Despite the advances, Foster considers the work hard, the hours long, the working conditions (like freezing sea spray) rugged, prices low and costs high. Indeed, Mike Street, Director of Research and Development, N.C. Division of Marine Fisheries, says that the major problems in the fishing industry are economic, not biological. Fisheries, he explains, operate strictly on supply and demand. Consequently, prices can fluctuate wildly, as, for example, when word of a big catch gets out.

Modern equipment allows Foster and another man to do the work it once took four to do, but Foster says the help doesn't come cheap. Last year, for example, he spent \$10,000 on equipment. "Everytime you turn around, you have to buy

ays Made Life Easier For Fishermen

something new... just the minimum" to remain competitive. The hydraulies, which can double a catch, cost anywhere from \$250 to \$4,000 and up. Enough floating and weighted sinking lines to rig inst one net can cost over \$70.

"Progress" has made fishermen more vulnerable to outside forces than in Austin's day, too. Fuel costs have risen. Nets, a petroleum product, have doubled in price. Insurance keeps going up. New Social Security regulations are tangling bookkeeping. And new Internal Revenue Service requirements will make it difficult for fishermen to use the old method of sharing equipment and catches by "fishing on shares."

These days, Foster says, it's hard for a newcomer to get started. Financing is hard to get, and with interest rates running around 10 percent, "It's as hard to pay them (loans) back as it is get them." As often happens, Foster did it by first working on someone else's boat and then buying a used boat.

Crowded Waters

Observers and fishermen agree, however, that recently younger men—like Bill Foster—have begun to take to the nets. And while the small operations like Foster's open boat are still popular and profitable, especially in the sounds, government officials note a trend toward more of the bigger trawlers as well. The large trawlers, about 55 feet and up, usually carry a larger crew and move more freely over greater distances, often farther out at sea. The trawlers are better able to move up and down the coast as seasons change.

The largest group vying for the increasingly crowded fishing space—over 18,000 vessels were registered in North Carolina last year—is made up of sports fishermen. North Carolina has a long tradition of sports fishing and although those catches are not monitored, they are estimated to be sizeable.

So far, most species have been able to sustain the increasingly heavy fishing. Fish are still largely plentiful in North Carolina coastal waters. Certain fisheries, though, are in trouble, while others are making a comeback. Shrimp catches are said

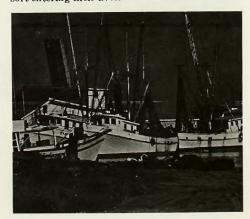
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to be increasing thanks to government management. Menhaden, of prime commercial importance, are "in trouble," says Harry Davis, Chief of Statistics, National Marine Fisheries Service, due to over-fishing.

In addition, Davis says, the river herring fishery is in trouble due to foreign fishing. There are foreign vessels in North Carolina coastal waters. But this area has not been as threatened as fisheries in the North have been. There the problem is acute. And, of course, that affects those North Carolina fishermen who follow fisheries that move north as well as south.

In fact, for a variety of reasons, Davis sees a shift in emphasis in Atlantic coast fishing in general. The northern fleet, he says, is deteriorating while the North Carolina fleet is growing and becoming more important. The total volume of the North Carolina catch now exceeds the combined catches of Virginia, Maryland, Delaware, New York, and Connecticut. And that means, says Davis, North Carolina fisheries will increasingly require management as more and more fishermen—some on trawlers from out of state—jockey for snace.

Fishing has changed some since Lawrence Austin's day. Although there are still some rather basic deficiencies in the industry—in icing, in distribution, in processing, in handling. Fishing has nevertheless begun the long evolutionary process from the solitude of a relatively few men with homemade nets to the crowded seas with scores of men and fancy machines. In an ever more crowded world with more mouths to feed, fishermen such as Bill Foster will soon find change of a different sort entering their lives.





As Fishing Increases,

So Does Talk Of Controls

(Continued from page 1)

U.S. catches remained between four and six billion pounds annually over the same period.

Indications are that demand for the sea's bounty will continue to grow. Competition for fish will increase—and still more species could be overfished. Declining fishery stocks could be the biggest problem for tomorrow's fisherman.

So what's to stop uncontrolled plunder of coastal waters? What can be done to insure a future for fishermen?

Some believe that "fisheries management" is the answer. The goal of managing fisheries is to improve or stabilize stocks so that all species continue to thrive. To reach this goal, a variety of controls is used to prevent damage to stocks.

Ideally, controls are based on a thorough knowledge of the abundance of each species and how much fishing each tolerates before it dwindles to dangerous levels.

Management tools aren't new to North Carolina fishermen. Official openings and closings of seasons, restrictions on gear and areas that can be fished and licensing are ways to control fishing and conserve stocks.

In the past, management has been carried out by the states. When the Division of Marine Fisheries, the agency charged with maintaining coastal fisheries in North Carolina, plants oyster cultches in Brunswick County waters, it is taking action to encourage continued oyster production there. Since Marine Fisheries identified and closed nursery grounds to fishing in the Onslow area, the average harvest in nearby waters jumped from 8,500 pounds in 1971 to some 1.5 million pounds in 1974. Annual ups and downs in the shrimp harvest may have accounted for some of the increase, but management probably added significantly to the

But as foreign and domestic catches increase, many believe that broader controls are needed to conserve species that cross state boundaries or the 12-mile offshore boundary where U.S. control currently stops.

Already states are banning together to manage economically important species. The first of these regional management plans affecting North Caro-

linians concerns the shrimp fishery. North and South Carolina, Georgia and Florida have agreed to cooperate in setting season opening and closing dates, establishing regional licensing and reciprocal enforcement and furnishing data needed for management. Similar regional management plans for other species are in the works.

On an even broader scale, a national fisheries plan has been devised by the National Marine Fisheries Service which sets forth a framework of management involving state, regional and national coordination. Through this framework, it is hoped that fishery stocks will be restored and maintained at a level that meets future U.S. needs—and that keeps tomorrow's fisherman in business.

About Those Controls...

Here are some of the management tools which are and will be used to insure that we have enough fish to meet tomorrow's needs. These controls govern what the fisherman can and cannot do.

Quotas—Limits are set on the amounts of fish and shellfish which may be harvested over a specific time period.

Gear Restrictions—Net length and mesh size are regulated, clam dredge weights are controlled. Certain nets used to capture certain species are prohibited.

Season Restrictions—Season opening and closing dates are set regulating when specific species may be fished.

Area Restrictions—Certain areas, deemed important as nursery and breeding grounds, are declared off-limits to fishermen.

Limited Entry—The number of persons permitted to fish for specific species is controlled.

Size Limits—Clams, oysters, crabs and some fish below a minimum size may not to be harvested.

Prospects Look Good For New Wanchese Port

Visions of a major fishing center in the Roanoke Island town of Wanchese have danced in the heads of some of that community's residents for nearly two decades.

Their visions aren't a reality yet. But the day when their dreams may finally come true seems closer

A recent \$325,000 grant by the Coastal Plains Regional Commission, a \$500,000 appropriation earmarked for harbor construction after July 1 by the N.C. General Assembly, endorsement by an influential organization of water resources experts and increased support from seafood industries have significantly boosted the project this year, according to Alvah Ward, seafood industries consultant from the N.C. Department of Natural and Economic Resources.

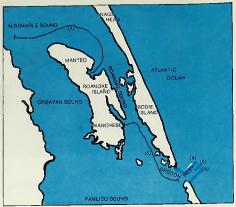
The proposed Wanchese Harbor project is a joint federal-state effort intended to spur the Tarheel seafood industry and coastal economy by providing improved channels to rich offshore fishing grounds and a harbor complex where seafood processors and distributors and a wide range of support industries could lease space for their operations from the State Ports Authority.

According to Ward, the need for additional detailed studies of the social, economic and environmental impact of the harbor by the Corps of Engineers might have slowed progress somewhat. But data gathered in the studies has helped keep the project alive during budget-tightening times by proving that economic benefits derived from the project will outweigh building costs.

Col. Dan McDonald of the N.C. Division of Environmental Management noted that estimated costs of deepening the harbor and channels and stabilizing Oregon Inlet—the federal phase of the project—have leaped from \$9.2 million in the 1960s to more than \$23 million today.

A Congressional appropriation of \$70,000 to the Corps of Engineers for completing design and engineering of the harbor, channels and jettles helps pave the way for actual dredging, according to McDonald. The first construction funds are expected to be appropriated for fiscal year '77 which begins Oct. 1, he said, adding that dredging could begin by spring, 1977.

Grant money totaling \$325,000 from the Coastal Plains Regional Commission (CPRC) should hasten the beginning of construction, Ward said, CPRC funds will support drawing a blueprint from the master harbor complex plan. Stan Beebe, CPRC program director, said his agency viewed the harbor as "the most pressing need in the seafood industry for all of the coastal plains states."



Proposed channel improvements to be done by the Corps of Engineers include (a) stabilization of Oregon Inlet with jetties, (b) a channel through the ocean bar at Oregon Inlet, (c) a channel from Oregon Onlet through Roanoke Sound to Wanchese and (d) a channel through Roanoke Sound to and through Albemarle Sound in deep water near the northern end of Croatan Sound. The Corps would also deepen and enlarge Wanchese harbor if the project is approved.

CPRC is also supporting feasibility studies for similar harbors in South Carolina and Georgia and funds have been set aside for engineering and design in those states.

Another significant push for the project, especially for the improvement of routes to the Atlantic, came this year when the U.S. Water Resources Congress, an influential organization of water resources experts, designated the project as one of "national urgency." The congress based its designation on the fact that the U.S. Coast Guard was called 168 times to assist vessels in the Oregon Inlet area from mid-1970 through last March.

Continued interest among seafood industries and among mid-West seafood distributors who would like to locate in the harbor complex and establish reliable supplies from Wanchese has also provided support for the project, Ward noted. "We now have 30 industrial prospects ready to talk turkey about locating in the harbor complex," Ward said, adding that they represent \$12.5 million in investments and would offer 445 new jobs.

Recounting other developments, Ward pointed to several changes made in the master plan of the harbor. A central gear storage area which will be available to fishermen for a nominal fee has been added and re-organization aimed at smoothing traffic flow in the harbor were the major changes he cited.

Despite optimism that the harbor is nearing realization, Ward warns that the entire project—both the harbor facilities and improved access to offshore fishing areas—must be completed if full potential is to be reached. "We can use the harbor alone to accomplish a good part of our mission. But we can never achieve our real purposes or reach full potential until we get the jetties," Ward said.

Will Limiting Foreign Catches Help North Carolina?

You're a North Carolina fisherman and all this talk about a 200-mile limit has you baffled. You read that the House of Representatives has passed a bill to extend United States jurisdiction over fishing out 200 miles from the nation's coastline. The Senate has acted on a similar bill. With differences in the bills worked out and without a presidential veto, extended jurisdiction will become law.

How would extended jurisdiction affect you?

If you're one of the vast majority of Tarheel fishermen who fishes the state's sounds and nearshore waters, extended control of fishing in distant offshore waters would probably have little effect—at least in the immediate future, according to Mike Street, director of research and development of the N.C. Division of Marine Fisheries.

But if you're one who fishes farther offshore, and particularly if you travel to New England waters to trawl, you may note some changes resulting from extended jurisdiction.

One change may be that you'll see fewer foreign



University of North Carolina Sea Grant Program 1235 Burlington Laboratories North Carolina State University Raleigh, N.C. 27607 fishing boats. One benefit may be more fish for U.S. fishermen.

In the past, there has been no attempt to conserve fisheries resources in the ocean. The rule has been that anyone who wanted to fish in waters beyond 12 miles from our shores had the right to do so.

In recent years, foreign fishing vessels have taken a heavy toll on some fish species. Overall, North Carolina landings have increased in spite of foreign fishing. But statistics show that fisheries biomass, all seafood flesh from fish to lobster, from Maine to Hatteras declined 55 per cent in the past decade, Street says. On the North Carolina coast, foreign fishing's most obvious effect has been the decline in the river herring catch from 20 million pounds in 1950 to 5.8 million pounds in 1970, Street said. River herring is caught offshore by foreign boats, but is fished by North Carolina fishermen when it migrates to inshore waters.

By extending jurisdiction to 200 miles, the U.S. could begin conserving fishery resources by limiting the foreign catch. If the legislation is passed, foreign vessels would not be excluded from our waters. But to fish in the 200 mile zone, other nations would have to strike agreements with the U.S. regulating where they could fish and the kinds of species and quantities they could catch. The proposed law would also give the U.S. the right to inspect and seize violating nations' vessels within the 200-mile zone.

The impact of extended jurisdiction would probably be most immediate for fishermen in North Atlantic and New England waters where some species have been seriously depleted by foreign boats.

In North Carolina's offshore waters, fishery stocks are abundant, Street says. But without extended jurisdiction, our resource could become seriously overfished in the future. For now, though, control of foreign fishing would help rebuild the river herring fishery here, Street says.



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UNIVERSITY OF NORTH CAROLINA

SEA GRANT PROGRAM NEWSLETTER

MARCH, 1976

1235 Burlington Laboratories NCSU, Raleigh, N.C. 27607 Tel: (91<u>9)</u> 737-2454

Energy From The Ocean: Is It Possible?

Sweaters are more popular. Windows are getting insulation. Advertisers tell us how many inches of insulation we need. The Arabs have us, literally, over a barrel. Electricity and gas prices keep going up. Fuel surcharges are now a part of life.

And the country is scrambling for new sources of energy. A number of possibilities—both large and small—are being considered. Some people say energy can be extracted from the oceans. Though the possibility is admittedly a small part of the larger picture, supporters of the idea are enthusiastic.

At a recent conference on energy from the oceans, scientists from Massachusetts to England gathered to discuss energy in wind, waves, temperature differentials and more. The conference, sponsored by NCSU Center for Marine and Coastal Studies, UNC Sea Grant, and the Coastal Plains Center for Marine Development Services, was held in Raleigh.

Three-fourths of this country's energy comes from oil and gas. As fossil fuels are exhausted in the next 25 years or so, the United States will become increasingly desperate for fuel. The government is exploring better ways to recover and use remaining fossil fuels (especially coal) and meet short-term needs. But at the same time, it is funding research in other long-range areas as well.

Some time after the year 2000, according to the Energy Research and Development Administration (ERDA), the nation will have to depend on essentially inexhaustible sources of energy. ERDA lists three major sources: fusion, the breeder reactor and solar electric power.

Almost half of the research budget is still devoted to nuclear power. Solar power—both land-

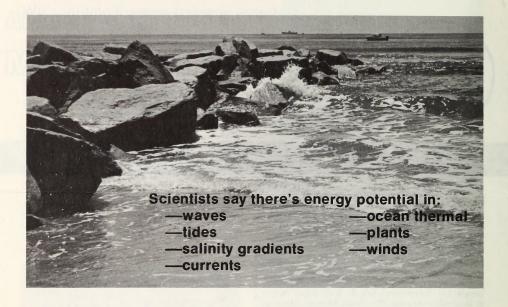


and ocean-based—gets only a tiny slice of the pie. But there are reports that solar power is becoming more popular. And, one method of capturing solar power from the oceans—thermal energy conversion—is expected to get more attention.

Of course, the problem with solar energy is: How does one capture the beast? ERDA is looking into both land- and sea-based methods. But at the ocean energy conference, scientists were particularly enthusiastic about the potential for the sea.

As one scientist explains it, the ocean is the largest, most efficient collector of the sun's energy. Then the question is: How does one get energy out of the ocean? To answer that, scientists here and abroad have begun looking at some schemes. They range from huge windmills to elaborate power plants reaching 1,500 feet down into the ocean.

(See "Plenty," page 2)



Plenty Of Ideas . . .

(Continued from page 1)

Some observers frankly put some of the ideas in a category with some of Jules Verne's more fantastic notions. But others say the ocean is the new frontier. And, after all, if someone had said 20 years ago that man would set foot on the moon, he

might have found himself locked up.

In England, ocean-energy research has centered on waves. Professor S. H. Salter, of the University of Edinburgh School of Engineering, says the area from Iceland to Land's End in England has "splendid waves." He says of waves in general "I'm sure there's more power than the world needs." Salter hopes to have the first experimental unit of his "nodding duck wave energy extractors" launched in two years. He envisions 50 or more of these 500 by 10 meter units (that's about a quarter of a mile long) eventually floating three or four miles off England.

France already has a tidal energy plant in operation and is building another one.

Here at home, a number of possibilities are being considered—some more enthusiastically than others—for tapping the ocean's stock of solar energy. Waves and tides have received some attention, as have currents. Salinity gradients, which would take advantage of the pressure produced where fresh water meets salt water, are also a possibility.

Some federally-funded research on waves and the potentially useful, yet environmentally questionable, salinity gradients is going on. But for the most part, the government's ocean-energy research has so far centered on:

—ocean thermal energy conversion, that is, the conversion into electricity of the substantial quantities of heat that are naturally collected and stored by the oceans;

—the conversion of ocean-grown plants, such as kelp, into more usable forms of energy;

—and wind power.

All three major areas are expected to contribute to energy needs by 1985. Every theory—including waves and such—has its followers. But at the conference, ocean thermal energy conversion (OTEC) received the lion's share of attention.

Robert Cohen, ERDA's chief of research for ocean thermal energy conversion, explained at the conference that he expects solar energy will be getting increased support as waste problems arise with the already-advanced nuclear energy. Consequently, OTEC—as part of the solar energy program—has begun to get more money and more attention. And Cohen has already initiated a more coordinated effort to begin to tap the sun's energy with OTECs.

What's an OTEC?

Who?—The U.S. government is funding ocean thermal energy conversion (OTEC) research through private industries, universities and non-profit organizations. Among the OTEC questions being examined are: legal ramifications, feasibility, costs and financing, environmental impact, heat exchangers, physical plant, by-products, biofouling of the equipment, transmission of electricity through cables to the mainland, heat loss, coldwater pipe technology and marketability.

What?—Proposed 500 megawatt plants are estimated in 1975 dollars to cost between \$300 and \$900 million each after the government picks up 35 percent of the tab. The price includes the cost of secondary production facilities (for ammonia for fertilizer or perhaps liquid hydrogen) which are proposed to increase investment and profit possibilities.

The plants are based on the theory that the oceans collect and store solar radiation as heat energy in the upper surface layer. And the difference between this upper water temperature and the cooler temperature at deeper reaches is large enough for a working fluid, perhaps ammonia or propane, to be vaporized at the higher temperature and condensed at the lower temperature. The working-fluid vapor turns a turbine, which drives a generator to produce electricity.

Why?—Because the government has determined that by the year 2020 combined solar sources must meet 25 percent of the nation's energy needs. OTEC is one of about nine proposed approaches—both land and sea based—to capturing solar energy.

When?—By 1977, the Energy Research and Development Administration plans to select a site for its first OTEC demonstration plant. Full commercialization is not anticipated until the turn of the century.

Where?—Various proposals locate OTECs (several of the plants will be required) in the Gulf of Mexico; off the coast of Brazil; in the Gulf Steam perhaps off Charleston, S.C. (though the Gulf Stream is considered an unstable resource); the Carribean;

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Hawaii; or southern California.

How?—OTEC components would be constructed generally on land and then towed out to the site where the pieces would then be assembled. One proposal calls for a facility reaching deeper than 1,500 feet (that's five football fields) below the surface. Others are based on more of a huge platform or ship-like design.

Some problems

—Cost seems to be a major problem with OTEC. This is being tackled from a number of angles. One is having the components—heat exchangers, plant, cold-water pipe—owned by different companies. Another possibility is to produce marketable substances—such as ammonia for fertilizer, edible

(See "More," page 4)

(More problems, continued from page 3)

foods, liquid hydrogen—as a concurrent process. And a third is simply to justify the high initial cost as a trade-off for not having recurring fuel costs.

Backers also point out that using cheaper materials—where feasible—would reduce costs. And, once the technology is perfected and performance of components improved, they say costs will surely drop.

Possible environmental consequences researchers have identified for OTEC vary from the impact of onshore shipyards to build the things; to the receiving plants for the cables; to the possible cumulative loss of heat in the ocean and threat to the resource itself as well as to the ocean's ecosystem; to raising the temperature of the water nearest the plant and adversely affecting living organisms.

Scientists are people, too

Twice before this country has shifted its primary forms of energy. In the 19th century, the switch was from wood to coal; and in this century, to oil and gas. Each time the changeover has taken about 60 years. The government says the country can't afford to spend 60 years this time—fossil fuels won't last that long.

Such a dramatic change does take time though. And the frustrations expressed by scientists at a recent conference on energy from the oceans point up some of the problems the country faces in the scramble for energy self-sufficiency.

Dr. Abrahim Lavi, professor of engineering at Carnegie Mellon University and supporter of ocean thermal energy conversion (OTEC), complained that the government hasn't been able to make up its mind about OTEC. There has been, he said, "a measure of timidity" on the part of the government.

The idea, he said, is being doomed on the basis of unnecessarily high cost estimates while the purportedly low cost of nuclear power is rising. And, Lavi said, despite increasing disappointment with nuclear power plants, industry is pushing that option "because they want to present us with a fait accompli."

Of the energy crisis in general, he said, "We have not responded to it in this country in the way that it is a crisis." The political problems, he said, "seem to be far more overwhelming than the technical problems."

And another, Professor William E. Heronemus, Department of Civil Engineering, University of Massachusetts—who has studied both wind power and OTEC extensively—echoed: "It's high time we start looking very seriously at energy from the sea . . . We ought to get on with this . . . I don't think we're headed on the right track at the national level . . . absolutely not."

He noted, too, the difficulties in getting research money and interesting power companies which are reluctant to invest in the unproven OTECs.

Professor S. H. Salter, the English wave expert, said that "from our side, we are astonished about the money... you can spoil a project by having too much money." And, he added, to a certain extent, he had done better before the British government stepped in with funding of his own project.

But others were not so pessimistic. Michael Mc-Cormick, an Energy Research and Development Administration (ERDA) consultant, said he was encouraged by the amount of interest shown by individuals who took the time either to write ERDA or drop in with proposals. These, he said, were the impetus behind the search for alternative energy sources.

And Frederick E. Naef, who presented Lockheed's proposed OTEC facility, admitted that plans could be speeded up if someone would decide to take the risk. But, he said, he felt the key was that "We're beginning to identify options to the use of nonrenewable resources. . Possibly some time in the future we are going to need these options." Given time, he said, the options can be developed.

N.C. Companies Remain Doubtful

All the talk of energy from the seas is, of course, rather theoretical at this point. Private investors are still largely dedicated to fossil fuels and the development of nuclear power. The electric companies that serve North Carolina are not ruling out energy from the oceans, but neither are they dashing out to get in on the ground floor.

At Carolina Power and Light (CP&L), spokesman Sid Linton says the company has no formal policy on energy from the oceans. In the near future, CP&L will concentrate on coal and nuclear power. And long-term research for CP&L and other major power companies, says Linton, is being done at the industry-sponsored Electric Power Research Institute (EPRI).

EPRI's planning for the year 2000 and beyond includes both solar and nuclear energy. As of December, 1975, the institute was funding 478 research and development projects in 31 program areas at an estimated cost of over \$400 million.

Bill Burton, spokesman for Duke Power Company, says they are "watching all developments in exotic forms of power... at the present stage it does not appear practical to get energy from the ocean." Tides are not good on the North Carolina coast. he says.

And, although "in theory, you could use (ocean thermal energy conversion), there are a lot of practical problems that have not gotten to the laboratory stage yet." Among those problems, he mentions footings for the heavy weight of the plant, maintenance and corrosion of equipment, wear on the turbines and equipment in general. Burton doesn't expect to see power from the ocean before the year 2000.

Duke's planning through the 1980s, Burton says, includes the only conventional, available sources—coal and uranium. "As supplies of coal and uranium are used up," he says, industry, with the help of EPRI, will have to go elsewhere for energy. But, he adds, it would "be foolish if we did not continue to develop better means to utilize existing sources."

Virginia Electric Power Company—Vepco, as it's called—serves about 10 northeastern North Carolina counties. Vepco spokesman Doug Cochrane says the company itself is involved in no particular research efforts. But cooperative research with other companies involves tides and wind, along with other forms of solar and geothermal energy.

The Law Of The Frontier-

In many ways, the oceans are the world's last frontier. As populations multiply, land and food will be scarcer, and nations will likely be compelled to turn to the sea for food, for space, for energy.

Demands on the oceans have already begun to increase. Huge ocean platforms are being built for oil rigs. The United States is adopting a 200-mile jurisdictional limit to protect already-threatened fisheries resources.

But the law—the traffic cop, if you will—is hopelessly behind the times. The traffic cop has rules to govern sailing vessels and the like. (Based on such factors as the shot of a cannon ball, which was the original determinant in the three-mile jurisdictional limit.) But the rules can't handle oil rigs as readily and certainly not numerous, large energy plants out at sea.

For example, no one is even sure whether or not an ocean energy plant would come under regulations governing vessels. Is a mammoth thing out there moored to the bottom by "chains" with links each possibly the size of a submarine really a vessel?

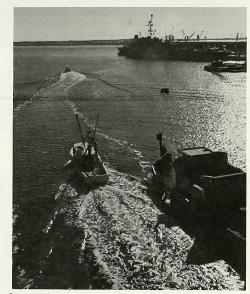
To try to predict, and perhaps answer, some of the legal questions raised by such plants, the American Society of International Law is participating in a study funded by the federal Energy Research and Development Administration (ERDA) and the National Science Foundation. The hope is that by beginning studies and discussions with policy makers now, technology and the law can be developed hand-in-hand, rather than by playing a game of catch-up.

Along with the lawyers, economists and engineers are examining both international and domestic issues. According to H. Gary Knight, professor of marine resources law at Louisiana State University Law Center and member of the study group, several major concerns are emerging:

International jurisdictions—Historically, the seas have been divided into a whole range of territorial zones. About nine years ago, the United Nations stirred things up, according to Knight, by suggesting some changes. As yet, though, nothing has been resolved and the laws remain unchanged but questioned. Knight isn't too hopeful about the prospects for resolution between the opposing sides.

Then too, the U.S. is adopting the 200-mile limit along its coast. Any power plant within that range would fall under the jurisdiction of the nearest state as well as the federal government.

Beyond that 200-mile zone, Third World issues are likely to be raised, says Knight, as those devel-



Increased demands on the ocean raise legal questions

oping nations are more and more asserting their right to a share in what's called "the common heritage of mankind"—the wealth of the seas.

Given the precedent of the Arab oil situation, it is easy to see why the researchers call the ocean a "political ocean."

Regulation—Going along with questions of jurisdiction are matters of regulation. In addition to international maritime agencies, a total of 11 domestic agencies would have a legitimate interest in the development of the sea, says Knight. Those regulatory agencies include, for example, the U.S. Army Corps of Engineers, ERDA and the Federal Energy Administration.

(In the case of the Louisiana superport, Knight says, the solution to the multiple regulatory agencies was to simply file a single application and then let the government figure out how to route it.)

Environment—Knight says new laws will probably be required as international principles for the protection of the environment develop. Domestically, the power plants would already be subject to the increasingly more sophisticated laws dealing

with environmental impact studies.

Some of the environmental issues an ocean thermal conversion plant raises include the discharge of working fluids in the event of a collision with a ship, change in the surrounding water temperature, and vulnerability to terrorism.

Multiple use—Due to the cost of these mammoth plants, every possible use will have to be developed. For example, the real estate above an ocean thermal energy conversion (OTEC) plant could conceivably be used as a fishing base, a shipping base, or a military base.

Knight says that could well lead to an ocean version of the land use planning being employed today to resolve conflicts.

Responsibility and liability—Here, Knight says, the laws are in a "real mess." An examination of both civil and criminal laws is needed. Questions center around, for example, who is responsible if an OTEC is hit and somone is hurt or dies? Do standard maritime rules apply? Is an injured worker due compenstaion? Under what regulations?

Just deciding whether an OTEC is a vessel—or part vessel—could determine whether it qualifies for favorable government financing of vessels.

Eleven papers are being prepared for the American Society of International Law study and the attorneys are, admittedly, looking for every possible stumbling block. But, says Knight, "If it works... it could save a lot of pain and trial and tribulation."

University of North Carolina Sea Grant Program 1235 Burlington Laboratories North Carolina State University Raleigh, N.C. 27607



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A few meetings

—73rd annual meeting of the N.C. Academy of Science, April 2-3, UNC-Wilmington. General session April 2: "Energy Production and Related Problems." For further information, contact John W. Reintjes, President, NCAS, National Marine Fisheries Service, Beaufort, N.C., 28516.

—Nationally oriented symposium on "Coastal Recreation Resources in an Urbanizing Environment," April 12-14, Hyannis, Mass. For further information, contact Arnold C. Lane, Cape Cod Extension Service, Deeds and Probate Building, Barnstable, Mass., 02630.

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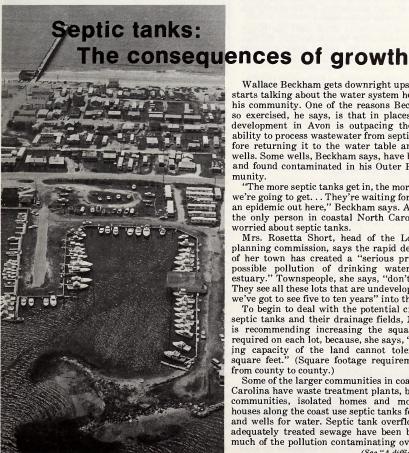


UNIVERSITY OF NORTH CA

SEA GRANT PROGRA NEWSLETTER

APRIL, 1976

1235 Burlington Laboratories NCSU, Raleigh, N.C. 27607 Tel: (919) 737-2454



Wallace Beckham gets downright upset when he starts talking about the water system he wants for his community. One of the reasons Beckham gets so exercised, he says, is that in places crowding development in Avon is outpacing the ground's ability to process wastewater from septic tanks before returning it to the water table and people's wells. Some wells, Beckham says, have been tested and found contaminated in his Outer Banks com-

"The more septic tanks get in, the more pollution we're going to get. . . They're waiting for us to have an epidemic out here," Beckham says. And he isn't the only person in coastal North Carolina who's

worried about septic tanks.

Mrs. Rosetta Short, head of the Long Beach planning commission, says the rapid development of her town has created a "serious problem and possible pollution of drinking water and the estuary." Townspeople, she says, "don't realize it. They see all these lots that are undeveloped . . . but we've got to see five to ten years" into the future.

To begin to deal with the potential crowding of septic tanks and their drainage fields, Mrs. Short is recommending increasing the square footage required on each lot, because, she says, "the carrying capacity of the land cannot tolerate 7,500 square feet." (Square footage requirements vary

from county to county.)

Some of the larger communities in coastal North Carolina have waste treatment plants, but smaller communities, isolated homes and most of the houses along the coast use septic tanks for disposal and wells for water. Septic tank overflow and inadequately treated sewage have been blamed for much of the pollution contaminating over 600,000

(See "A difficult," page 4)

The rules

So what's being done about regulating all those

septic tanks?

David Stick, vice chairman of the Coastal Resources Commission, says "There's no governmental entity which seems to have the jurisdiction for an overview . . . authority and responsibility are fragmented." And worse, "nobody can really tell us what the situation is."

But a couple of problems are evident:

-many observers, Stick among them, are quick to suggest that local sanitarians do an uneven job

of handing out septic tank permits;

—in addition, observers often fault the North Carolina Commission for Health Services for failing to adopt for homes the newer, more stringent regulations which are already being used for larger construction.

The "Rules and Regulations Governing the Disposal of Sewage from Any Residence, Place of Business, or Place of Public Assembly in North Carolina," were worked out jointly by the staffs of the Commission for Health Services and the Environmental Management Commission. Health Services will consider adoption of the joint resolution once again at a May 8 meeting in Pinehurst. (The public is invited. For details, write the commission at P.O. Box 2091, Raleigh, N.C. 27602.)

Septic tank oversight is spread between two state agencies and the local health departments. The health departments, under the Commission for Health Services, are responsible for overseeing most residential development. That is, those offices have jurisdiction over all construction that would generate no more than 3,000 gallons of sewage a

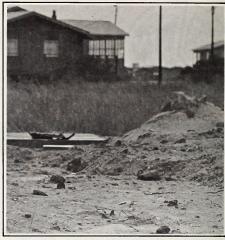
day.

Over 3,000 gallons a day or in a case of discharge into surface waters, the Environmental Management Commission oversees waste disposal and treatment. The commission manages such development as motels, condominiums, trailer parks, and commercial structures.

The Environmental Management Commission issued only about 40 permits last year for the larger projects under the joint resolution's stringent guidelines. But county health departments across the state allowed over 40,000 of the residential septic tanks to be installed.

Each county adopts its own guidelines. Until and if the Commission for Health Services adopts the tougher guidelines, the one common denominator in county enforcement is the state's minimum standard set forth in the Ground Absorption and Sewage Disposal Act of 1973.

The Act requires two permits be issued by local sanitarians. One is required before construction



An open septic tank drainage field

begins and the other upon completion of construction. Septic tank drainage fields—large beds of gravel—are left open for the sanitarian to inspect. Such factors as character and porosity of the soil, percolation rate, topography, depth of the water table, and location of water-supply wells are considered.

The hitch is that enforcement of the Act is left up to local sanitarians and boards of health, which, according to Stick, "vary tremendously."

Some sanitarians, he says, enforce the law to the letter, but others might "let 'em get by with everything." And Mike Bell, coastal regional engineer for the Commission for Health Services, admits "we do have this problem in some areas." But, he adds, the real problem is often in the politicking of local health departments, county commissioners and such.

"Politics plays a very big role in this . . . I feel it was politics that helped withstand the implementation of the joint resolution regulations." When tough cases arise, Bell says the sanitarians don't always get the backing they need from higher ups.

Had the Commission for Health Services adopted tougher regulations, Bell says, there would have been a lot more turn downs on septic tank permits

than are already occurring.

In Dare County, A. C. Turnage, regional engineer for the Environmental Management Commission says "the potential for pollution of that water supply is dangerous." But county sanitarian Joe Stokes insists that his county has one of the strongest septic tank regulations in the state. "The criticism we're getting is not justified," he says. Finally, stricter dredge and fill regulations

Finally, stricter dredge and fill regulations should help avoid creating bad septic tank situa-

tions for the future.

The future: more questions than answers

Since beach houses and summer fun and normal population growth are a fact of life, the septic tank problems in coastal North Carolina won't vanish overnight. Sanitarians will continue to face the insistent demands for just one more house. Businessmen will continue to demand a clear path to the tourist's dollar. And tourists will continue to demand their place in the sun.

Septic tanks and sewage disposal plants are already taxed to capacity in some places. David Stick, vice chairman of the Coastal Resources Commission, says existing regulations are out-

dated.

Questions arise about the carrying capacity of different regions, how far septic tanks must be from bodies of water, whether the cumulative effect of ostensibly correct septic tanks will turn out to be detrimental, what the viable alternatives are, what can be done about existing problems not covered under construction-oriented regulations. And the state is only beginning to learn what the relevant questions about long-term consequences are.

What's being done?

Clearly, damage has already been done. The question is: How much, and what must be done to stop further damage?

To help answer that question:

—The Coastal Resources Commission (CRC) is taking a look at the situation. The CRC's aim, according to Kenneth D. Stewart, executive director, is "to stimulate the agencies that presently have authority in this area to act." The CRC hopes to impress upon local governments their existing authority to regulate septic tanks, upon state agencies the need to enforce existing regulations, upon the Commission for Health Services the need to adopt stricter guidelines, and upon county governments the need to consider sewage disposal in their development plans for the Coastal Area Management Act.

Observers say in a pinch the CRC could possibly exercise some more direct control in the Areas of Environmental Concern (AECs). But that control would be fragmentary, they say, at best. It could be extensive in some counties, but not in others,

they say.

—Federal and state government are offering some limited money to municipalities for planning and construction in direct point-source waste treatment. Several coastal communities and counties, among them Surf City, Carteret County and the Dare County Outer Banks, have received a share of this "201 money." But Barry Williams, head of the Department of Natural and Economic Resources task force on 201 planning, says the money

will likely soon run out. It is, he says, "not going to take care of the septic tank problem by any means."

Besides, he says, despite the number of coastal communities involved, the 201 planning money is "still really taking care of a small geographic area of the coast." No construction money has been awarded in the coastal area.

Further, none of the limited federal area-wide water quality planning money has gone to the

coast, either.

Where to turn?

Some people say the only way to turn is to the ocean to dump treated sewage offshore from regional systems. That possibility is being studied under several grants in the state. The Coastal Plains Regional Commission and the Environmental Protection Agency recently appropriated money for a study of the environmental and economic effects of disposing of municipal sewage through ocean outfall. And L. J. Pietrafesa, NCSU, is studying ocean circulation characteristics for outfall possibilities under UNC Sea Grant funding.

Objections to ocean outfall have been raised. And some scientists say there should be other alternatives. Dr. B. L. Carlile, assistant professor of soil science at NCSU, says on-land irrigation of sewage over the vast wastelands along the coast would be

a better alternative for larger systems.

For smaller systems, for all those scattered backyards, Carlile is studying several methods with the hope of developing something that will only be halfagain as expensive as conventional septic tanks (under \$1,000).

Carlile sees most promise for the coastal areas in a low pressure pipe system, and a mound system that provides an artificial nitrification field well above the water table. Carlile's methods are being tried out in a development in Perquimans County

on Holiday Island.

The long-range questions, though, are far from being answered. Some say there are simply no good alternatives to septic tanks and that the answer must lie in some sort of large-scale regional systems. The questions, at least, are beginning to be asked. But, the answers still lie in the future.

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'A difficult situation'

(Continued from page 1)

acres of the state's shellfishing waters.

Here and there on the coast, crisis points have already begun to spring up. In the Surf City area, according to Mike Bell, regional engineer for the state Commission for Health Services, the uncontrolled installation of septic tanks and the location of septic tanks too near the water's edge have allowed wastewater to seep into the sound without natural treatment.

David Stick, vice chairman of the Coastal Resources Commission, adds to the problem areas "almost any place on the Outer Banks... Bogue Banks."

It sounds like one of those boring issues that planners and government officials fight over. But as Wallace Beckham, the state's shellfishermen, and the residents of towns like Surf City and Long Beach are discovering, septic tanks can be crucially important. They can affect the quality of the water we drink and the food we take from the sea, not to mention our health.

A septic tank is a relatively simple apparatus that, once hooked up and buried in somebody's backyard, is supposed to filter out gross wastes and then release liquids to percolate through the soil and eventually back into the ground water. The idea is that during percolation, bacteria will absorb the contaminants.

To work properly, a septic tank's drainage field must not be too porous or too dense, and it must not be too near drinking water supplies. If the soil is too porous, the liquid rushes through before the pollutants can be absorbed. If the soil is too dense—impervious—then the wastewater may either sit near the surface and not be further absorbed, or move laterally to pollute surface waters and other backyards. If the wastewaters are discharged too near a shallow water table, then the drinking water can be contaminated.

The soil and water table at the coast make septic tanks a tricky business. The soil is frequently completely sand. The wastewater can just rush through. Or, the soil is pervious fill material dump-

ed on top of often impervious soil which will not absorb the wastewater properly. Or, the water table is very near the ground's surface and wastewaters don't have far enough to percolate before entering the ground water. In Avon, for example, Beckham says wells need only be sunk seven feet. And septic tank systems are required to be at least two feet above the water table, he adds.

With high land prices, lots on the coast are often small and land is at a premium. According to A. C. Turnage, coastal district engineer for the Environmental Management Commission, "there's a lot of development taking place on the coast that involves filling in on marsh . . . these sites are not suitable for septic tanks."

Problems with the soil and water table are aggravated by the increasingly dense development on the coast. In fact, the Coastal Resources Commission, which is overseeing implementation of the Coastal Area Management Act, has heard testimony that almost 90 percent of the soil in the coastal region is unsuitable for conventional septic tanks.

"The problem is critical now"

But, of course, much of that land has already been developed. Turnage says "in many of these beach areas, the problem is critical now." Though Dare County hasn't reached the critical levels Carteret County beaches and the Surf City area have, Turnage says, "they (in Dare County) are putting a tremendous amount of septic tank effluent into the ground in a rather restricted area." The drinking water in Dare comes from a thin layer of ground water, Turnage says, and the potential for contamination of the water "is quite considerable."

Turnage says regulatory agencies have already reached the point of having to turn down requests for septic tank or other treatment permits due to the near saturation in some areas. Until municipalities can begin to put in sewage systems, he adds, "I see a real difficult situation to contend with for the next three or four years" along the coast.

University of North Carolina Sea Grant Program 1235 Burlington Laboratories North Carolina State University Raleigh, N.C. 27607



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UNIVERSITY OF NORTH-CHAROLINA

SEA GRANT PROGRAM NEWSLETTER

MAY, 1976

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Making the most of our bounty from the sea





Mrs. Emma Avery makes no bones about it. In her work she deliberately fools people and she's proud of it.

Mrs. Avery is tricky. You have to watch her or the first thing you know, you'll be munching away on some nice stuffed clams or pizza or meatloaf or sausage, only to find out that she's tricked you into eating something that's more "fish flakes" than clam or meat.

"We fool people in our work," she says. "We mix different seafoods together and kind of camouflage the one that we're using the most of." Like "crab cakes" are more fish flake than expensive crab. "We think we're eating all-crab cakes."

(See "Seafood Lab," page 2)

Seafood Lab looks at glazing, flaki

(Continued from page 1)

And Mrs. Avery isn't the only person to watch out for. There's a bunch of them—called Nutrition Leaders—who meet every month at the UNC Sea Grant Seafood Laboratory in Morehead City to come up with more and better ways to use often unpopular, wasted and cheaper fish as well as stretch more expensive seafoods. The fish flakes are something the group cooks up to get more mileage out of fish.

"We're always experimenting," says Mrs. Avery. As a result, she's learned "that I could eat fish in many different ways." She's passed that infor-

mation on to the club she represents.

Problem is, while North Carolina fishermen bring in about 3 percent of the nation's catch, they get about 1 percent of the national value. And besides, a lot of fish is wasted in culling and processing.

So, part of the Seafood Lab's work is to boost the market and help industry as well as the consumer. The idea is to help fish processors market a better product and put unpopular, wasted seafoods to work.

The folks at the lab are always coming up with things that make for better seafood, whether it's a method of glazing to lock in flavors or smoking to add more flavor or a recipe to use a new product—such as the fish flakes.

But their work has to start long before that at the crucial point when the fish is taken from the water where deterioration can set in. To help fishermen and handlers take better care of fish, Ted Miller, Food Science Extension Specialist at the Seafood Lab, will be looking into improved ways to get the fish iced as quickly as possible.

That's because Seafood Lab studies show that proper handling extends shelf-life markedly. And that's also why the folks at the Seafood Lab have worked extensively with processors to streamline and speed up their operations. The idea, Miller explains, is "to keep it clean, keep it cool and keep

it moving."

And to get the product from dock to market, the Seafood Lab is working with the Cryovac Division, W.R. Grace and Company, in cooperative tests of packaging. The tests involve using a skrinkable bag that molds itself to the contour of the fish and locks out air.

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Pizza topped with a seafood sauce promises to offer good way to use "trash" fish.

The lab is also studying processes and new pro ucts. Like Mrs. Avery and her home-cooked flak fish, extensive work has also been done with m chanical deboning of fish for commercial use.

And, so far, studies on the effects of freezing c seafood indicate that consumers are as happy wir properly handled frozen fish as with fresh. R cently, with Sea Grant's help North Carolina processors have been branching out into more froze fish, Miller says.

The work in handling, freezing and packagir is part of an attempt to help processors take a vantage of potential products and extend season variety—to enable them to handle and sell croak when there is no flounder, for example.

The Seafood Lab is looking for ways to use the variety of fish readily available in North Carolin waters, but not welcome on Tar Heel tables.

One study involves examining the physic properties of the relatively unpopular croaker duing freezing. The study is also intended to establis

icing, and more

uniform standards for measuring consumer preferences.

But croaker is getting more of a workout than that. The Nutrition Leaders—Mrs. Avery and 11 other women who represent various Carteret County clubs and serve as the Seafood Lab's link between scientists and consumers—have snuck croaker into a nutritious pizza using the flaking method. The process is to steam just about any bony, unpopular fish (head and all) to get just about all the meat off the bones and then use it in anything from the pizza sauce to meatloaf to salad. The idea is to camouflage the fish, as Mrs. Avery says, but also to make fish more manageable, stretch more expensive seafoods and meats and get more protein per food dollar.

The same principle applies to similar work the women have done with such species as shad, a once popular bony fish that's fallen into disrepute; and such unknowns as cobia and amberjack, which are frequently discarded by sportsfishermen (who are, by the way, estimated to get more than 25 percent

of the state's catch).

Some hints from the Seafood Lab on getting the most out of that fish:

- —It isn't necessary to gut small- to medium-sized fish before freezing in plastic wrap. In fact, fish frozen "in the round" and then partially thawed is much easier to dress.
- —Whenever possible, use the glaze recipe on page 5 to lock in flavors and lock out air.

—And quick chill and superchill (p. 5) to protect your catch from deterioration.

- —To thaw small- to medium-sized fish frozen whole and enhance the flavor, soak it in a solution of 5 Tsp. of salt and one quart of water for about 30 minutes. Thaw fillets the same way in about 15 minutes. In either case, no further salting is necessary.
- —In deciding how to cook a fish that's been frozen, remember that freezing doesn't seem to affect taste but it does affect texture.
- —If you use a microwave oven, remember that fish will require less liquid and butter. Also, a uniform thickness helps. The microwave is good for sauce dishes and thawing, the Seafood Lab has found, but won't give crispness.

Waste Not, Want Not

Waste not, want not, the saying goes. And whoever first said it could have been thinking of flaked fish. The UNC Sea Grant Seafood Lab's method of steaming and flaking can be used on just about any fish. And when it's done, there isn't much left for the trash except the bones.

To flake fish and make fish broth:

1. Get a fish that's been scaled, headed and gutted. Keep the heads, removing only the gills. Be sure the body cavity has been completely cleared of membrane and blood streak.

2. In a large pot, melt ¼ stick of butter and saute for 10 minutes pieces of carrot, onion, celery tops, a bay leaf, garlic and spices to taste.

3. Then add fish and heads on top of vegetables. Add enough water to half submerge the fish, cover and boil for about 40 minutes. Then remove the fish.

4. Allow fish to cool, scrape off skin, shake meat from backbone.

5. Fish flakes, now ready to use in pizza sauce, meatloaf, salad, crab cakes or what-have-you, should be checked for small bones.

6. To finish the broth for chowder, sauces and other dishes, return backbones and skin to pot. Cover and continue cooking for ½ hour. Use a potato masher to squeeze broth from solids. Discard the solids and pour liquid into a saucepan. Reduce volume from ½ to ⅓, cool in refrigerator until broth congeals.

7. Remove solid fat layer from top and unsightly material from bottom. And the broth is ready for use or storage.

NOTE: For flakes in a hurry and no fancy broth, steam fish in water only.

Try some of these fish flake and broth recipes:

Chowder

11/2 cups fish flakes

11/2 cups clams chopped

6 medium white potatoes, diced

5 cups water

6 Tbsp. melted margarine

1 medium onion, diced salt and pepper to taste

1 cup fish broth

Combine fish flakes, clams, potatoes, water, margarine and onion. Bring to boiling point. Add salt, pepper and fish broth. Cook until potatoes are done. (Clams will get tough if over-cooked.)

Wash and boil the crab cases. Toast bread

and place in blender until ground fine. Mix,

in a large bowl, bread crumbs, eggs, mayon-

naise, Worcestershire sauce, grated onion.

lemon juice, margarine, parsley, salt and

pepper. Mix in crab meat, fish flakes and

fish broth. Stuff mixture into crab cases.

Sprinkle with paprika and bake in 250°

oven for 25-30 minutes or until slightly

Crab-Fish Imperial

2 cups toasted bread crumbs (prepared from sliced white bread toasted dark)

2 eggs

3 Tbsp. mayonnaise

2 Tbsp. Worcestershire sauce

1 small onion, minced juice of ½ lemon with scraping from rind

1 stick margarine, melted

½ Tsp. parsley

salt and pepper to taste

1 cup fish flakes 1 cup crab meat

paprika
1 cup fish broth

20 crab cases

. . .

browned on top.

Stuffed Clam

2 cups to a sted bread crumbs

2 eggs

3 Tbsp. mayonnaise

2 Tbsp. Worcestershire sauce

1 small onion, grated juice of ½ lemon with scraping from rind

11/2 cups of fish flakes

1 cup fish broth 1 stick margarine, melted

½ Tsp. parsley salt and pepper to taste paprika

10 ounces of minced clams (reserve liquid)

20 hard clam shells—about 4" in diameter

Wash and boil 20 hard clam shells. Toast bread and place in blender until ground fine. Mix, in a large bowl, bread crumbs, eggs, mayonnaise, Worcestershire sauce, grated onion, lemon juice, margarine, parsley and pepper. Add clams, fish flakes and fish broth to mixture. Use liquid drained from clams to adjust the consistency to something resembling bread dough. Stuff mixture into clam shells. Sprinkle with paprika. Bake in 350° oven for 25-30 minutes or until slightly browned on top.



To keep that fish tasting good, keep it c-c-cold . . .

Sea Grant researchers have found that proper chilling and icing can allow a fisherman to hold his catch up to seven days without loss of quality.

First, quick chill that fish the moment it's caught:

- -Take along a tub and some crushed ice.
- —In the tub, pour sea water over the ice, creating a slush.
- —Drop fish into the slush for about one-half hour.
- —Remove fish from slush and smother in crushed ice until the end of the day. Fish may be whole or gutted when iced.

Then, at day's end, superchill fish:

- —Line the bottom of an isulated ice chest with about 4 inches of crushed ice. Leave the bottom drain open.
- —In another container, make a salt-ice mixture, using 1 pound of coarse ice cream salt with each 20 pounds of crushed ice.
- Arrange the fish in layers in the ice chest, generously covering each layer of fish with a salt-ice mixture.
- -Always keep the lid securely on cooler.

If salt is not available, crushed ice alone will do, but fish will maintain quality for only two or three days.

Whole fish may be superchilled in direct contact with salt-ice mixture. But if you plan to superchill fillets, steaks or dressed fish, first protect them by wrapping in a clear, plastic film before arranging in layers in the chest.

... and glaze it to lock in flavors

The UNC Sea Grant folks at the Seafood Lab and the Nutrition Leaders have found that dipping fish in a glaze before freezing makes the fish last longer and protects the flavor.

Nutrition Leader Emma Avery explains, "It forms a seal over the meat so the air doesn't get to the meat . . . that's what causes the frozen foods (to), we call it, get strong."

Sea Grant scientists recommend applying a dip solution to whole, dressed or filleted fish before wrapping for freezing. They say the solution helps keep fish tasting, smelling and looking fresh because it slows the interaction of oxygen with fish fats.

To make the solution, you'll need:

- 2 Tbsp. unflavored gelatin
- ½ cup lemon juice
- 31/2 cups water

Stir gelatin into 1 cup cold water. Heat remaining water and lemon juice to near boiling. Stir cold gelatin mixture into hot liquid until it is almost clear. Cool the dip solution to about room temperature before use.

Dip and drain fish. Then wrap in Saran Wrap.* To wrap, tear off 12 to 18 inches of plastic. Lap plastic over sides, then ends.

Whole fish, if fairly small, may be arranged "sardine style." Fillets should be packed with meat side away from folds. If freezing on a small scale, researchers recommend placing packages, folds down, on a metal tray.

*This does not imply endorsement of a product on the part of the Seafood Lab.



Off the presses

Following is a list of new UNC Sea Grant publications. North Carolina residents may order one free copy of each publication by contacting the Sea Grant office.

Ecological determinants of coastal area management: Vol. I—An overview; Vol. II—Appendices. Brower, David. UNC-SG-76-05.

Estuarine shoreline erosion in the Albemarle-Pamlico region of N.C. Bellis, V., M.P. O'Connor and S. R. Riggs. UNC-SG-75-29.

Don't waste that fish: tips on taking care of your catch. Berg, D. R., T. M. Miller and F. B. Thomas. UNC-SG-75-23.

Aerial photography for planning and development in eastern North Carolina: a handbook and directory. Baker, Simon. UNC-SG-76-03.

Chemical control of *Lagenidium*, a fungal pathogen of marine crustacea. Bland, C. E. and D. G. Ruch. UNC-SG-76-02.

About all those fish stories . . .

The gettin' places for more seafood info: For tips on taking care of your catch and a book on commercial packaging and glazing write UNC Sea Grant, Box 5001, Raleigh, North Carolina, 27607.

For fish flaking facts and recipes, pointers on shad deboning and mechanical deboning, write UNC Sea Grant Seafood Laboratory, P. O. Box 51, Morehead City, North Carolina, 28557.



Septic tanks in crowded beach developments are posing problems for some coastal towns.

Update: septic tanks

Last month we reported that the septic tank situation in coastal North Carolina is causing citizens as well as the Coastal Resources Commission concern.

The problem is that the soils and high water table along the coast make septic tanks a tricky business. More and more, septic tanks are becoming health hazards.

In response to the problem, UNC Sea Grant Director Dr. B.J. Copeland has announced a new research project.

Initially, researchers will look at alternatives to backyard septic tanks; septic tanks and other alternatives in different types of coastal soils; and assess the current situation on the barrier islands.

It's hoped that the work will spell out what is and isn't viable in the way of backyard sewage disposal.

Collaborating on the project are: Dr. Bobby Carlile and Dr. Larry D. King (NCSU-Soil Science) and Dr. Mark Sobsey (UNC-CH-Environmental Science and Engineering).

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UNIVERSITY OF NORTH CAROLINA



SEA GRANT PROGRAM NEWSLETTER

JUNE, 1976

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Marketing is affected by supply . . .

So, the problems with marketing are there. But, as Paul Allsbrook—one of several state officials charged with promoting seafood sales—says, "There's nothing you can put your hand on."

There are, however, certain words that pop up in conversation after conversation: supply, quality, processing, labor, distribution channels and outlets. And, in general, federal and state agencies working to boost seafood marketing are trying to do something with the problems that stand behind those words.

Allsbrook is convinced that the solution to the supply problem is processing. "North Carolina does not have a sophisticated seafood industry. Our big problem is our industry is not process-oriented. ... Let's harvest all these fish (when there's a glut), freeze them, and sell them later."

Processing, he adds, would also appeal more in today's market. "The industry is not meeting the market's demand in the way of preparation of the product. . . It's just a matter of convenience that people are buying frozen."

At Sea Safari in Belhaven, Mae Reinhardt and her associates decided to give processing a try. They converted an old oil warehouse into a fish processing and freezing plant and went into business.

Getting buyers to accept a frozen, filleted piece of fish was a problem, as was getting the popular fish. While the going was slow at first, Mrs. Rein-

In this crab house, workers pick meat and pack it in plastic containers which are then weighed





In this newly-converted plant, finfish are filleted by workers at individual stalls before being frozen

hardt says larger restaurants are beginning to buy from Sea Safari, and "the local restaurants are beginning to accept it more," too.

But supply is still a problem, despite the processing. Though Sea Safari buys most of its fish in North Carolina, it sometimes has to buy from New York and elsewhere to get the popular species. "There's been weeks we couldn't work because we couldn't get anything to sell." What they can sell, what restaurants mostly want, are flounder, blue fish and trout.

Mrs. Reinhardt stands by the decision to go into freezing and filleting. "That's the direction," she says, "the fish will be fresher." And, as the company grows, she hopes they'll be able to build up a large enough backlog of frozen seafood to smooth out the highs and lows of supply.

Meanwhile, a Sea Grant research project this summer will begin taking a look at finfish processing. Dr. James Easley, NCSU School of Economics and Business, says he hopes to begin to answer the question, "Will processing pay?" Easley will examine returns, how sensitive the return is to the number of months a plant operates, and prices.

Sea Grant advisory agents are working on more efficient gear for fishermen. And researchers at the UNC Sea Grant Seafood Laboratory in Morehead City are trying to come up with more and better uses for fish—both popular and not so popular.



Fish are packed in ice and loaded onto trucks for the journey to market

... By quality ...

Fish change hands a number of times on the way to the table and each time proper care must be taken of the highly perishable stuff. Sometimes people fall down. It takes a long time to win a customer back.

"No doubt it's a problem," Allsbrook says, "in some areas, fishermen do not take care of the product." Then, too, sanitary conditions in seafood plants may soon come under fire. Allsbrook says "You're going to see some big changes in the next four or five years. . . Food and Drug (the federal Food and Drug Administration) is really tearing into those people."

Others fault some retailers for selling "fresh" fish that's actually been frozen in the round and thawed (and may not have been so fresh even when it was frozen). That gives fish a bad reputation, they say. Some say the often poor locations, odor and general atmosphere of some retail stores inland don't help sell North Carolina seafood, either.

"Seafood in the past has been a dirty thing," says Ralph Jarvis, president of the North Carolina Fisheries Association and a seafood dealer himself. "It's changed a lot in the last few years. We've come a long ways, but there's still a whole lot that can be done with keeping fish fresh. . . But on the average, most of the larger fish dealers are doing a good job."

To help improve seafood quality from water to table. Sea Grant researchers and advisory agents have been working with fishermen and handlers on boat insulation, proper icing and freezing methods, plant design, and packaging.

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These oysters were loaded onto a small truck which carried them to the larger truck at right which in turn carried them to a northern soup company

... By channels of distribution

But that's only half the battle. Says Jarvis, channels a boost by sponsoring trips to the Mid-"There's definitely a lot lacking in our marketing of the finfish. There's a need for new market outlets for finfish, that's our weakest thing." It's an area the Fisheries Association has agreed to work on.

At East Carolina University's Business School, Dr. John Summey has been taking a look at the distribution channels for the state's seafood. His Sea Grant-supported work has revealed a real "hodge podge affair" with "undefined channels of distribution."

If he can find a common thread, if there is one, Summey hopes the industry will be able to use the information to better serve the public.

"I don't have anything solid . . . there seem to be a number of different ways fish move," depending on the size of the dealer, how big the catch is, the demand in the North, and the difficulty in (and West. resistance to) inland delivery in North Carolina.

It's a basic supply and demand situation, Summey says, the product moves where the price is best and the hassle is least. And that's often in large shipments moving North, rather than smaller mixed shipments moving inland.

In part, Summey thinks the problems of getting seafood inland in North Carolina are "a real communications, awareness problem. A lot of it is that these people (buyers inland) don't know who on the coast is shipping inland."

The state, along with the Coastal Plains Regional Commission, has tried to give distribution Wanchese.

west to promote North Carolina seafood. Last year, a trip to Chicago was arranged for dealers.

Allsbrook, who arranged the trip, says the buyers "want the product either headed and gutted or filleted." And, they want it in small orders.

"The difficulty we have had is in getting our industry to respond to these small orders ... we've had some success, the biggest problem has been transportation."

In Washington, N.C., Milton Evans, who sends three or four loaded trucks North each day, says "the people in Virginia have got us whipped" on the Midwest trade. They can put a small shipment on a truck that's going that way anyway, he says. But no trucks from here have similar routes, so a whole truck-load would have to be made up to go

One thing that Jarvis thinks will help is the port facility planned for Wanchese harbor. "That's going to be a big help, it'll be a big supply area, it would attract a lot of attention."

And Alvah Ward, another of the state's seafood promoters, agrees, "our greatest need in North Carolina now is to develop centers of distribution ... we are fast approaching the time for centralization." Wanchese Harbor fits the bill, "The total concept is to have at one central point an area from which both fresh and frozen product can move." Ward thinks construction can begin this fall at

N.C. seafood marketing-

- 600 documented companies
- · over 200 retail stores
- countless new restaurants
- worth over \$20 million to fishermen
- worth \$80 million at the retail level



Marketing: growing pains aplenty

(Continued from page 1)

That thing called "marketing" is inextricably tied to the state of the seafood industry which in North Carolina is variously described as being: unsophisticated, unresponsive to consumer needs, enough and getting along fine, thank you.

Complaints about the state of seafood marketing seem to dominate:

Ralph Jarvis, president of the North Carolina Fisheries Association and a processor himself, says particular species. Of late, he's seen croaker thrown away because prices got so bad.

Fish dealer Willie Etheridge III in Wanchese says business, with so many small dealers trying to sell fish, is highly competitive.

Seafood distributor Bob Fergus in Wilmington says he can't always get enough seafood from dealers to fill his orders.

Retailer Bill Butler in Charlotte says the market is so fragmented he is sometimes forced to buy from as many as 10 different distributors to get the variety he wants. And, he has to take delivery whenever he can get it-even if it's after church on a Sunday afternoon as a truck passes through on its way to New York from Alabama.

It sounds pretty contradictory, but maybe it isn't. The glut Jarvis talks about is a trick of nature, and, since about 60% of the state's seafood is marketed fresh, only a limited amount can be used at any given time.

The competition to sell fish reflects the ups and downs of supply, too. But also, fragmentationand smallness of most operations-imply that most dealers can't command a price.

Likewise, the scarceness of popular fish out of season (again, because most are handled fresh), that Butler and Fergus talk about has forced fragmented and chaotic; or, profitable, efficient them to buy out of state to maintain a variety for their customers. As distributor Milton Evans in Washington, N.C., explains, "the better variety vou've got, the more fish you'll sell."

The crazy quilt-work pattern of distribution leads one observer to call seafood marketing in the market can't absorb the occassional gluts of a North Carolina a real "hodge podge." Despite that, marketing continues to expand. There are now 600 documented seafood companies, over 200 retail stores, and countless new seafood restaurants in

> Ex-vessel prices, those paid to the fishermen, have more than doubled since 1968. Seafood is now a \$20-million industry for fishermen and an \$80million industry by the time the product reaches the consumer.

> In 1975, there were nine new coastal seafood plants or major expansions for a total of almost \$2.5 million in capital investments. As a result, 320 new employees were hired. Three more houses began "cutting fish"-processing by heading, gutting, filleting-last year, too.

> Seafood marketing seems to be suffering some growing pains. It's long been a highly individualized enterprise. But sheer miles to ever-more distant markets to the final consumer, volume to be handled, and fragmentation have created problems.

So who would buy the fish?

really want more fish? Paul Allsbrook, a state-employed seafood promoter, says ves. Allsbrook sees more and more new seafood restaurants and retail markets. For example, he says, at least eight restaurants have opened in Raleigh in the past five

"There's more and more interest in seafoods, we have more calls. . . People are eating more and more seafood out, there's no doubt about that. . . Everybody has different conceptions of how to market. My basic concern is to gear their facilities to produce products in a manner in which the consumer wants it."

Down at East Carolina University's Business School, Sea Grant researcher John Summey also thinks more attention should be paid to the consumer. Efficiency can be increased readily enough, he says, new products can be created, and so on.

But "the only thing we haven't done anything on is selling fish. . . It's a lot easier to sell something the consumer wants." So, next year, Summey proposes a research project which would take a look at consumers; who they are; how they use fish;

But what about demand? Do people what their hang-ups about fish are; and whether or not the retailer effectively reaches them.

> Summey raises the question, for example, of why so many people eat seafood in restaurants where cooking has been reduced to a science, rather than at home.

> Judging from national figures, there should be plenty of people to sell fish to if Summey can figure out why they aren't buying now. In 1975, the annual per capita consumption of beef was 119.5 pounds, pork 55 pounds, poultry 48.5 pounds. Though the figures aren't out vet, fish will probably come in at around 12 pounds per person, to be followed only by yeal, and lamb or mutton, at 4 and 2 pounds respectively.

> Because the low seafood consumption is a national phenomenon, a recent national Sea Grant conference on marketing agreed to examine the problem. Among other questions, researchers would like to answer: what the demand characteristics for seafood are: and why so much (78.2% of domestic sales) fish is sold through institutional channels (hospitals, the military, etc.) rather than retail markets.

University of North Carolina Sea Grant Program 1235 Burlington Laboratories North Carolina State University Raleigh, N. C. 27607



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SEA GRANT PROGRAM NEWSLETTER

July, 1976

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Sea Grant advisory agent Hughes Tillet lifts a rack of oysters for inspection.

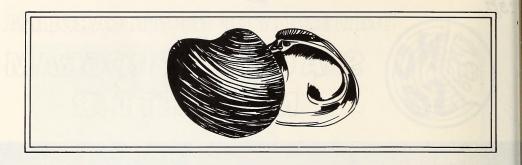
Growing Your Own . . . **Clams and Oysters**

Inlanders put in their okra and cabbage seeds; folks on the coast are planting seed oysters and clams in an experiment in shellfish gardening on the North Carolina Outer Banks.

The experiment began in the Pamlico Sound when Sea Grant advisory agents Sumner Midgett and Hughes Tillet sowed 50,000 clams smaller than half an inch in the sand behind Lawrence Lee Austin's Hatteras home. Midgett and Tillet had intended to scatter the infant clams inside a protective wire pen, but the clams arrived before the pen did. The Sea Grant team learned an important lesson when all 50,000 clams were wiped out; protective pens are important to the success of cultured clams.

That was three years ago and Midgett and Tillet are continuing to learn about clam, and more recently, oyster aquaculture. Through Sea Grant and Pocket of Excellence funds, ten people from Oregon Inlet to Atlantic have started clam and oyster gardens and one-Lawrence Lee Austinhas already reaped the benefits of a harvest. Austin won't say exactly how much he profited from the sale of his cultured clams, but he was encouraged enough to wade through two and a half years of red tape to get a state lease for 12.7 acres of bottom land. Austin plans to gradually find the best places on his acreage for gardening and-if the economics work out-turn clam and oyster farming into a full-time occupation.

(See "From Seed," page 5)



Bringing Clams to the Backyard in Buxton

Barbara and Luther Midgett, of Buxton, raise hunting dogs, bees, vegetables, children and—in a new venture—clams.

"We had what we consider an ideal farming situation in our backyard and we knew another man had farmed successfully in Hatteras," Barbara Midgett says to explain the 30-by-100 feet clam pen installed behind her home in November 1975. "We'd always raked wild clams so we thought why not call Hughes and Sumner and see if we were eligible for a pilot project."

Sumner Midgett and Hughes Tillet, the Sea Grant clam farming explorers, looked over the area and decided it looked prime for clam production. They helped the Midgetts build a protective pen of vinyl coated wire. Treated wood pilings were installed about every 10 feet and the structure was given a life expectancy of at least five years, Barbara Midgett says.

"We really don't have to do anything. We just go and look at them and clear off any debris and watch for crabs."

The pen was then divided into seven smaller sections. Two thousand eighth-inch size seed clams were placed in one section, 2,000 quarter-inch in the next and 4,000 three-eighths inch clams in the next. The other four sections were filled with clams with a diameter of five-eighths of an inch. Twenty-five hundred of these clams were put in two parts of the pen and 3,500 in the remaining two sections. Sea Grant will monitor the operation to see which sizes and densities of clams grow best.

"We really don't have to do anything," Barbara Midgett says. "We just go and look at them and clear off any debris and watch for crabs. We've had low mortality and considerable growth. We look to harvesting cherrystone-size clams 16 months from last November."

The Midgetts have applied for a lease for five acres of bottom off their own 225-foot shoreline. If the lease comes through they plan to go into the clam business as a sideline. They're expecting at least 100 per cent profit on their \$300 to \$400 investment and are looking at marketing outside the state, where prices may be higher.

"So far, so good," Barbara Midgett says of the project. "The clams are doing fine—the weather doesn't seem to affect them and I don't think we've lost more than 40 or 50 from the total. I'm fascinated by it and I think it's an excellent idea because there's a tremendous demand for clams inland and limited space where they can be farmed.

"And anywhere they're successful it's additional food supply for the United States."



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If The Romans Could Do It, Eph O'Neal Thinks He Can Do It, Too

When Ephriam O'Neal looks at the handmade raft floating in a shallow canal near Cape Hatteras, visions of Oyster Bars dance in his head.

The cause of the reverie is 75,000 seed oysters maturing in plastic racks suspended from the raft. Sea Grant agents Sumner Midgett and Hughes Tillet planted O'Neal's oysters in February and May and the shells have already doubled their original thumb nail size.

"I'm telling you they're growing fast," O'Neal says with satisfaction as he surveys his crop.

O'Neal is magistrate in Hatteras and operates a marina. He also fishes in the winter. Several years ago he tried to open an oyster bar but found it difficult to get the oysters when he needed them to be decided to lease some bottom land to plant oysters, but when he learned of the off-bottom methods being practiced in Japan and now on the Outer Banks he saw some definite advantages.

"With these oysters here if you offered me a price and I didn't like it, I wouldn't have to throw my oysters away. I could just leave them in the water growing until the market is right."

The most immediate benefit would be to avoid the hassle of trying to get a state lease—no small chore nowadays. O'Neal simply asked the landowners abutting the canal for permission to float his raft in the water. He will need a lease, however, if he expands his pilot project.

O'Neal also believes he can avoid two other major headaches—problems with the weather and the market. Because his raft is tied in a protected area it is spared the worst of the elements. The water surrounding the growing oysters is polluted, however, and O'Neal will have to transfer his mature crop to clean water for a period of time before he can sell it for human consumption. But he figures he will only cleanse limited amounts of oysters at one time decreasing the risks of losses in the open water.

He is hopeful he will also be able to protect his crop from the uncertainties of the market.

"We have a lot of potential in the water going to waste and one of the biggest reasons is marketing and controlled seafood pricing," he explains. "If you catch oysters on the bottom, you have a limited amount of time to market them fresh. You have to take what you can get. But with these oys-



Eph O'Neal, of Hatteras

ters here if you offered me a price and I didn't like it, I wouldn't have to throw my oysters away if I chose not to sell them. I could just leave them in the water growing until the market is right."

The ability to control the timing of sales plus the scarcity of local oysters will put the off-bottom oyster grower in a top marketing position, O'Neal says, as long as the demand is there. Demand for oysters has remained stable in the U.S. while the supply has decreased. Oysters are now selling for \$4 to \$8 a bushel, with about 300 oysters per

(See "Rebirth," page 4)



Sea Grant agent Hughes Tillet checks Eph O'Neal's oyster raft. The ropes on the raft are attached to racks of trays holding quantities of small seed oysters. The racks must be cleaned of fouling plants and animals.

Rebirth of a Growing Culture

bushel. The large single oysters get the best prices and, while rare in nature, they are the type easily grown off the bottom.

O'Neal will also be able to harvest and sell oysters year-round while oysters taken from the bottom may only be sold from October through March.

O'Neal is enthusiastic about the future of his oyster business but he concedes there are still several unknowns. The oyster trays and possibly the oysters have to be cleaned while they are growing and neither O'Neal nor Sea Grant knows yet how much labor or time will be involved. Oyster farming has its roots in ancient Rome and Gaul and is practiced widely around the world, but

mainly in countries such as Japan where labor costs are low.

O'Neal and Sea Grant are talking about coating the trays with antifouling paint or pulling them out of the water once a week to discourage algae and other growth. But they have not yet explored what effect these actions might have on the growth of the oysters or the humans who eat them.

Sea Grant and O'Neal are watching the situation closely and watching similar work being done abroad and up and down the Atlantic coast. Hopefully, they will have the answers soon to the questions that will determine whether oyster farming is economically feasible on the North Carolina Outer Banks.

From Seed to Cash: How do North Carolina's New Gardens Grow?

Midgett and Tillet are reluctant to advise everyone to plunge into oyster and clam farming, since the project's economic feasibility is still being tested. But they are hopeful that the pilot oyster and clam plots will achieve the intended goal of providing another way for coastal people to gain income from the water.

"We're basically looking for ways for people to make a little money with only a little money," Midgett says. "You can take a million dollars and do anything, but we're looking for a way for a guy without much capital to do something."

When people approach Midgett and Tillet about farming, the two agents begin by examining the site. Clams and oysters like shallow water with relatively high salinity, strong tidal currents and plenty of food. The gardens must also be in an area where they can be observed and protected from vandals.

If the conditions look favorable, a pilot project can be set. For clams, this means building a pen, three-by-four feet usually, of either vinyl-coated wire or plastic netting and pipe, extending about six inches below the sand and three feet above the water level to keep out blue crabs and other predators.

"You can take a million dollars and do anything, but we're looking for a way for a quy without much capital to do something."

Seed clams—usually about 1,000 from the hatchery in Morehead City—are then tossed into the pen where they bed themselves in the sand. If they die in a week you can be fairly sure you're in the wrong place; although Midgett says he has had clams prosper when moved only 100 feet. After that, it's simply a matter of watching for holes in the wire and philandering crabs, raking off seaweed and waiting an estimated 16 to 18 months for the clams to grow to marketable size.

Farming oysters is a little more involved. Experience and a trip to Japan have shown that oysters grow best when off the bottom and the Sea Grant agents have been experimenting with, among other methods, racks of plastic trays suspended from pontoon rafts. The trays are perforated with small holes which must be kept open to keep water flowing over the seed oysters. Midgett and Tillet began planting oysters last August and they've found the racks of trays need cleaning weekly in the summer to keep algae from clogging the holes. The racks used to date must also be in protected water but Sea Grant is investigating new designs which could be placed in open waters. They

are also looking for other, less expensive materials.

Depending on water temperature, location, salinity and a myriad of other factors, oysters take from one to three years to grow from three-quarter inch to marketable size. And both clams and oysters appear to do better if they are set out in the fall.









"It's a lengthy process and unless you have money to gamble it's best to play it safe," Midgett says. "How much money can you make? It's a good question and there are no truths because everything varies.

"For example, if you bought 1,000 seed clams for a penny a piece, you could sell them for from four to eight cents, depending on who you sold to and when. Then you have to figure in how many you lose, and we've had 95 per cent survival to total loss. If all factors were favorable I don't see why you couldn't get 85 to 90 per cent survival. That brings you \$24 to \$58 profit for 1,000 seed clams. And they claim you can raise 75 clams per square foot although I'd say between 50 and 75 to start and spread them out as they get bigger.

"And, of course, you have to include the investment for the pens and the lease. The state charges \$5 an acre to lease bottom and the applicant must pay to have the land surveyed." The state leases only commercially unproductive and unpolluted bottom land which will be developed to produce at least 25 bushels per acre.

"It's a lengthy process and unless you have money to gamble it's best to play it safe. How much money can you make? It's a good question and there are no truths because everything varies."

Midgett personally has no doubts about the feasibility of the clam project, although he thinks the oyster venture is still too young to be assessed.

"It's all in the experimental stage and people getting into it will have to use their own judgment and ideas," he adds.

But using his imagination, he can picture triple decker farming with clams on the sound floor, oysters suspended from wire cages on the pen and scallops on the top.

Persons interested in finding out more about oyster and clam gardening can contact Midgett and Tillet at 473-3937.

Room for Growth: North Carolina Joins the Aquaculture Experimenters

North Carolina is not alone in its quest for practical and economical ways to farm clams and oysters. Work is being done on both the Pacific and Atlantic coasts.

Maine is particularly active in oyster aquaculture and one commercial enterprise, Maine Coast Oyster Corp., is now selling oysters planted with Sea Grant help. The oysters have grown to market size in two years and are selling for 20 cents a piece at latest report. The oysters are grown in floating trays in racks nine-deep. In the winter they are moved to the bottom to avoid problems with icing.

A little closer to home, Frank Wilde is successfully growing oysters in Chincoteague Bay, Va. The oysters are set in single floating trays which are positioned in rows. Wilde grows his crop from spat to marketable plump, single oyster.

Off-bottom culture is also being researched, through Sea Grant, in South Carolina and Oregon.

Clam aquaculture is being explored in Virginia, Massachusetts and Washington. And growing mussels the Spanish way, on rafts, is being tested in Maine.

"There's definitely a potential for growth."

Prognosises for the future vary, but, according to T. Pillay, fishery resources officer with the United Nations, mollusk farming is the second most promising

arena in the aquaculture world.

"There's definitely a potential for growth," says National Sea Grant Advisory Agent Bill Shaw. "Almost all Japanese oysters are grown off-bottom now, for example, which shows it's a way to do it. Japan is about level with us now on oyster production, even though they have much less area, because they're using the third dimension."

In North Carolina the potential is there for more shellfish production, according to Mike Street of the Division of Marine Fisheries.

The state ranks low in oyster and clam production and only plants about 80 acres of bottom to oysters and clams a year, he says. But thousands more acres are available, although more than 60,000 acres of good growing bottom is now inaccessible because of pollution.

"Japan is about level with us now in oyster production, even though they have much less area, because they're using the third dimension."

If the Sea Grant projects pan out and find ways to overcome economic and, in some areas, legal problems, oyster and clam gardening—with the advantages of fast, choice growth relatively free from predators—may find a welcome place on the North Carolina coast.

University of North Carolina Sea Grant Program 1235 Burlington Laboratories North Carolina State University Raleigh, N.C. 27607



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SEA GRANT COLLEGE NEWSLETTER

August, 1976

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Trading oysters for beans?

... the question of fresh water

In the old West, the issue was fences. On the North Carolina coast, it's ditches and "fresh water intrusion."

Fresh water intrusion is the runoff of fresh water into normally brackish or salty water. The definition is simple but the implications are complex. Many of the brackish, estuary waters that receive fresh water such as rain are also the nursery grounds for shrimp, oysters, flounder, trout and other commercially important marine life. These creatures can adapt to a wide range of salinities and temperatures, but they all have limits to the amount of fresh water they can stand. And they may be hurt by rapid fluctuations in water's salt content.

Other factors are involved, but according to a study on brown shrimp done by the North Carolina Division of Marine Fisheries, salinity is a major ingredient for survival in the estuaries.

Runoff has always occurred along the coast. When it rained, the fresh rainwater eventually found its way to the shore. But in recent years, as corporations have cleared vast acreages for "superfarms" and developers have made room for homes, the face of the coastal area has changed. Mazes of drainage ditches now make more avenues for fresh water to rush to the brackish coastal areas. And fewer swamp forests are present to trap the water and slowly filter it to the shore.



The problem: changing land use

(Continued from page one)

Now when it rains, rainwater can run in wide channels to the brackish nursery areas, opening the possibility for changing salinity rapidly and altering the directions of water flow. The effect could be destruction of the nursery grounds.

The problem, according to the state report, is particularly prevalent in tributaries of the northern Pamlico Sound, such as Long Shoal River, Swanquarter Bay and Rose Bay. And fishermen in those areas are getting worried, and upset.

Opposition has focused on one drainage operation in Hyde County which would drain 1,200 acres into Rose Bay. A law suit was filed and is now in limbo, according to Swanquarter attorney John S. Fletcher. He calls the suit a "warning to the landowner that people felt he was doing something he shouldn't and that if anything went wrong they'd look to him for recompense" and a "notice to the government to do something."

The fishermen brought their worries to the state more directly in June:



Rose Bay oyster houses stand empty.

"We, the undersigned, being commercial and sport fishermen who use the creeks, rivers and bays adjacent to Pamlico Sound and the waters of Pamlico Sound, petition the Marine Fisheries Commission and state officials as follows:

"—to investigate the invasion of traditionally salt or brackish waters by fresh water.

"—to investigate the effect of changing salinity in said waters upon the production of oysters, shrimp and other salt water species.

"—to initiate programs to preserve the traditional salt waters of the aforesaid waters.

"—to investigate the effect of decreased salinity in said waters upon the economy of the Pamlico drainage area, and to initiate proper controls to insure the continued health of commercial and sport fishing in this area.

"—to investigate the feasibility of dredging Ocracoke Inlet or a new inlet near the Ocracoke

"This petition is prompted by the belief that



Troy Mayo

during the past decade the fresh water has been encroaching upon salt water areas in a gradual, but persistent manner."

The petition was signed with about 3,000 names and carried to Raleigh by fisherman Harold Harris and his neighbor Troy Mayo. Harris has fished Rose Bay and the sound for 10 years and Mayo is a native of Swanquarter who fished a quarter of a century ago and now works an oyster bed in the middle of Pamlico Sound. Harris and Mayo agree Rose Bay production is down and they point to fresh water intrusion as the main culprit.

"The bureaucrats and educated fools can't see what's going on without a study. But you can ask the stupidest person in Hyde County and he'll tell you," Mayo declared. "The damage has been done in the past 10 years by the big corporate farms. We've got sense enough to know that farming has to continue but if we don't stop these big corporate farms or get some new laws, all these sounds and bays and tributaries will be gone.

"Twenty-five years ago, I owned a 26-foot shad boat. We used to go out in Rose Bay, two people, for five or six hours and we'd catch 35 to 40 tubs of oysters—that was two men pulling by hand," Mayo continued. "Today you go out in this same area with a power winder and all modern equipment and I'd be surprised if you catch 10 tubs of oysters. Up until about five years ago we had 10 to 15 people that made their living just in Rose Bay. Today you haven't got a one—it's just that simple."

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More than one culprit—a many-faceted situation

The problem is a little more complicated, according to Fentress ("Red") Munden of the Oyster Rehabilitation Section of the Division of Marine Fisheries. He agrees that state oyster production has dropped considerably in the past 25 years, although the drop has leveled off in the last five years. But fresh water intrusion is only part of the cause.

Extreme overharvesting at the turn of the century is still hurting today's oyster production, Munden said. And passage of minimum wage laws helped close the oyster shucking houses that had produced a major source of cultch—the broken shells scattered on the water's bottom to catch oyster spat, or seed. With less readily available cultch, there was less shell material going back into the water to develop oyster beds, Munden explained. Harvesting pressures, particularly in Rose Bay which has an exceptionally fine oyster, also took their toll, he said. Recently low prices due to low oyster demand have encouraged fishermen to

A dredging operation in the Rose Bay area. The water will eventually wind its way to Rose Bay itself.

diversify and depend more on crabs and shrimp, he added.

"Fresh water definitely plays a part, but oyster production is very complex. You can't put your finger on one thing and say 'Aha, this is it,' "Munden said. "I can't deny, though, that I feel very strongly that fresh water intrusion is a problem.

But we'd do better to approach it not from oyster production, but from shrimp—they're more susceptible to water changes."

A study of juvenile shrimp in Rose Bay showed that fresh water intrusion definitely disrupted the salinity of small creeks in the area. The result was a smaller shrimp harvest by fishermen, particularly if salinity dipped and fluctuated during the critical early spring months.

The study is not conclusive, though, according to its author, Preston Pate, of the Division of Marine Fisheries. The state really does not know the extent of the fresh water intrusion problem, Pate said.

To find the "truth," the Environmental Management Commission has authorized another study, based on the demands in the Rose Bay petition. This study is expected to take three years and will look at the problem, its solutions and their costs and benefits as well as possible legislation.

Wrinkles in the law

Right now most fresh water intrusion is not under any government jurisdiction. State dredge and fill laws apply only to marsh areas and estuarine water. And, according to Pate and permit coordinator John Parker, much of the draining is done where there is either no marsh, not enough to justify refusal of a permit or in areas that do not drain directly into the estuaries.

The Army Corps of Engineers was scheduled to gain regulatory control this summer over activity in wetlands adjacent to tributaries of navigable waters. President Ford issued a moratorium on the law, however, and the wording would exclude much of the land now being drained and all ditches now in operation, according to Corps spokesman Wayne Wright.

Sedimentation control laws apply to the silt flowing in the water, but not the freshwater itself. And agricultural and forestry lands are exempt, according to Taylor Currin, Chief Engineer in the Department of Natural and Economic Resources (DNER) Land Quality Section.

The Coastal Area Management Act, with its provisions for designating special areas of environmental concern, also excludes farming and logging operations. Attempts to change the law so it would apply to farming or logging would be "practically impossible politically," according to one DNER official.

(See "Plodding," page four)

Plodding along; so far, so good?

(Continued from page three)

"At present time, no one has regulatory authority over fresh water going into salt water," concluded Robert A. Carter, head of the Water Quality Operations Branch of the Division of Environmental Management. "It's a pollutant to salt water organisms, but it's not defined as such."

UNC Sea Grant Director B. J. Copeland says there is a possibility that his program may become involved in the state study on Rose Bay. Sea Grant researchers have already been studying runoff effects of the Open Grounds superfarm and a Water Resources Research Institute study of First Colony Farms has just begun.

If fresh water runoff is identified as a pollution problem, several controls have already been suggested. One idea is to leave a buffer zone between drainage projects and the shorelines to retard fresh water intrusion. Diverting drainage ditches into deeper areas of the sounds or into less productive nursery areas where excess fresh water would have less impact is another idea. Or the draining water could be maneuvered to a large holding area where it would be released more slowly.

Any state action will take time, Pate said, but any action must be backed with hard data.

"The problem is not so severe that there's any potential for complete destruction of, say, the shrimp industry. But we feel if the trend continues in converting these highly valuable nursery areas into fresh water habitat, the effects will certainly be detrimental to the seafood industry. We want to attack the problem as rapidly as we logistically can. We recognize that just because the drainage ways are there, the potential is there for some drastic effects—even if it doesn't occur 100 times out of 100."

"We love beans and beef and we have a serious need to extend agricultural operations," Jim Brown, also of the Division of Marine Fisheries, added. "At the same time we dearly love shrimp and oysters. There exists a very serious need for imposing compatability between the two. Can it be done? That's the question. Can it be done under existing authorities or does it mean we'll have to pass new laws and add more control to the existing maze we have now. Or do we just keep plodding along with our fingers crossed?

"The problem has been developing probably since the very first drainage projects," Brown continued. "We've been aware of it as a potential problem for 10 to 12 years but only recently have we come up with any data that pinpoints it as a serious problem. The initial effect is reducing the effectiveness of some of our more productive nursery areas. The subsequent effect that bothers us is the type of pollution that may result from the land use at the other end—the possibilities of accidents with pesticides and runoff of fertilizer.

"The whole thing sometimes reminds me of the fellow who jumped off the Empire State Building. When he passed the 13th floor he saw there was a party going on. He waved and said 'So far, so good.'"



Drained and logged land, an increasingly common coastal sight.

University of North Carolina Sea Grant College 1235 Burlington Laboratories North Carolina State University Raleigh, N.C. 27607



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N. C.

ERSITY OF NORTH CAROLI

SEA GRANT COLLEG NEWSLETTER

September, 1976

1235 Burlington Laboratories NCSU, Raleigh, N.C. 27607 Tel: (919) 737-2454

Creeping and Crawling on Currituck Sound

the dilemma of Eurasian Watermilfoil

In 1959 people noticed strange, long plants growing in a pond on the Pea Island refuge. The plants disappeared after the Great Ash Wednesday storm of 1962 and people forgot about the incident. Then in 1964, Currituck Sound fishermen began noticing similar patches of weed. A year later one patch had spread over 100 acres and by 1968, 8,000 acres of Currituck Sound were completely covered and 67,000 more acres were showing the plant. Today an estimated 60,000 to 80,000 acres in Currituck Sound, Kitty Hawk Bay, Little, Perquimans, Pasquotank and Alligator Rivers, East Lake, Point Harbor, Martin Point Creek and Back Bay, Va., are tangled with the weed-Eurasian Watermilfoil.

THE RESERVE OF THE PARTY OF THE

Since its arrival milfoil has snarled fishing lines, gummed boat motors, tipped sailboats and provoked quarrels between the bass sport fishermen who think the milfoil helps fishing and the residents and commercial fishermen who think milfoil is a pain in the neck.

THE RESERVE OF THE PROPERTY OF

Local residents complain about the mosquitoes, flies and spiders that inhabit the milfoil and the rotten egg smell that arises every fall when the plant rots and drifts to shore in large putrid mats. Eel fishermen curse the milfoil when they pull dead eels from their traps. Shoreline property owners grumble that their land's resale value has probably dipped. One woman lost her home when the firefighters' pumps clogged with milfoil from the Sound. And one man states flatly that Currituck Sound is "sick."

DELICATION OF SERVICE

"It's a mess. There's no doubt about it," sighed Currituck County Manager Graham Pervier.

Where did milfoil come from? What is it? Why is it here? And what can we do about



Coping with milfoil—what can and cannot be done...

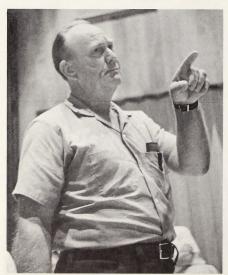
Eurasian milfoil, or *Myriophyllum spicatum*, is an exotic, rooted water plant native to Europe and Asia. It is an aggressive grower and can survive in a wide range of temperatures, depths and salinities. Generally the plant prefers water with less than one-third to one-half salinity. Milfoil needs light to live.

Scientists speculate that milfoil came to the U.S. in the 1880s on a foreign ship. Fragments of milfoil can root and begin new plants: the plant has the capacity to grow 64.000 branches from one branch in three months. Milfoil can also propagate through seeds and winter buds. So it is not surprising that the weed quickly crept from New Jersey to the Chesapeake Bay where it was a problem in the 1950s and 1960s until it mysteriously died away. Milfoil is now a pest from North Carolina to Canada, Wisconsin, New York, Florida and in the Tennessee Valley Authority Lakes.

A bone-crunching hurricane would probably do a lot to alleviate the milfoil infestation of Currituck Sound, but other less capricious methods of control are available. All of the known controls, however, are either costly, slow, risky or still in

the research stage.

Chemical control with the herbicide 2,4-D has already been tried on a very small-scale in North Carolina. The state sprayed selected areas in 1968, 1971 and 1974. Nine hundred acres of Kitty Hawk Bay which were sprayed in 1974 are still relatively



Coinjock resident L. C. Barrow

free of milfoil and other native plants. Martin Point and Point Harbor, however, which were dosed in 1971 and 1974, were buried in the weed by the summer of 1975.

No short-term harmful effects have been found with 2,4-D according to Thayer Broili of the Department of Natural and Economic Resources (DNER). But there is always the danger of future unknown impacts, so the state is reluctant to make a full-scale chemical attack on the weed, Broili said

"It's basically a stop-gap measure that would have to be repeated every one, two or three years," he said. "It could be used effectively in limited areas, but I think we'd be in for a big mess if we used it for a large-scale operation." Plus, 2,4-D spraying costs an estimated \$60 an acre, he said.

Many Currituck and Dare County residents believe that salinity control is the answer to their milfoil problems. Scientists agree that milfoil could probably be controlled by raising the salinity of Currituck Sound to one-third or one-half sea strength. But the environmental and economic

implications are large.

First the economics: In order to raise the salinity of Currituck Sound and keep it at a level inhospitable to milfoil, approximately \$17 to \$18 million would have to be spent in the first year if pumping were used. Another estimated \$3.2 million would have to be spent annually. It would take from 55 to 145 days to reach the correct salinity level and constant maintenance would be required, according to Ernest Knowles of the NCSU Center for Coastal and Marine Studies.

If an inlet were cut between the sound and the sea, \$10.2 million would have to be spent initially, Knowles estimated. And constant dredging would be needed to keep the inlet open, he said.

Environmentally the picture is also gloomy, especially for the bass fishermen and the local people who depend on the bass fishing business: milfoil may not like high salinity, but neither do the bass.

"It's obvious if we raise the salinity to levels that will control the milfoil we'll eliminate the fresh water species and the fisheries that go along with it," said Don Baker, Chief of the Inland Fisheries Division of the State Wildlife Resources Commission. "If we choose that route, it will be very expensive. Besides, we're talking about inducing changes we really won't be able to control. I don't think we have the expertise to do it, or the financing."

Mechanical mowing and harvesting of milfoil is a control method now being practiced in parts of the United States and Canada. Machines on gawky, paddle-driven rafts chop the tops of the plants and

(See "Looking," page 3)



A weed harvester manufactured by the Aquamarine Corp. at work on a Wisconsin lake.

Looking at the solutions: a confusing array of choices

(Continued from page 2)

clear the debris, providing immediate relief for clogged waterways and offended eyes. Mowing and harvesting would have to be repeated, perhaps several times a season, and the machines are still slow—a good machine can cover an acre an hour, according to expert Don Livermore of the University of Wisconsin.

"Mechanically harvesting 80,000 acres is too much to think about," Livermore confessed. "It boggles the mind."

Mowing and harvesting limited areas is conceivable, although the machines are expensive. A single harvesting system costs between \$50,000 to \$100,000, according to C. Brate Bryant, president of the harvester-producing company Aquamarine Corporation. But community groups and counties have purchased them for use on Wisconsin Lakes, he said.

In North Carolina, however, counties are not allowed to spend ad valoreum tax money, and probably not any tax money, for any type of aquatic plant control, according to Ron Aycock, attorney for the N.C. Association of County Commissioners. The state has the authority but has not set aside any funds for milfoil control. The U.S. Army Corps of Engineers can also take on the milfoil battle but only at the request of state or local governments.

And any Corps project must be justified on a costbenefit ratio, according to spokesman Otis Johnson.

The financial problems associated with milfoil harvesting might disappear if an economic use could be found for the weed. "If they found a way for it to make people money, there wouldn't be a sprig left in a year," predicted Coinjock resident Marcus Griggs.

Research is underway to find cheaper and more efficient ways of harvesting and to find ways to economically convert milfoil into animal feed, silage (unfortunately, so far, cows hate the taste), fertilizer, compost and other products. Milfoil is also being investigated as a sewage treater and a methane gas supplier, according to Bryant, and is already used as a mulch.

Since milfoil depends on light, another way to control the weed would be through shading. Plants such as lotus could be grown over the milfoil to block the light, suggested Ron Stanley, of the Environmental Protection Agency. "The milfoil would eventually go, but then you'd have water lotus which is just as difficult to get through," he said discouragingly. "Also it would take many years to stop the milfoil here because lotus grows very slowly."

(See "Coping," page 4)

To the rescue . . Sea Grant tackles the milfoil problem

So what do we do about milfoil?

UNC Sea Grant began meeting the milfoil problem July 23 and 24 with a conference at the Marine Resources Center at Roanoke Island. State officials and milfoil experts—both scientists and local residents—met and shared what they knew and didn't know about the weed. Then S. E. Caroon, a spokesman for the Coinjock Ruritan Club, implored the gathering to provide the hard data needed to get some action.

"Currituck Sound is Currituck County's greatest asset and Currituck Sound is sick. It's sick and it needs help."

"I am convinced that people in Raleigh don't really know how acute the problem is," Caroon told the group. "We who live along the Sound have only the Currituck Sound as our laboratory. Our tools are our eyes, our nose and the taking of life from the Sound. That's all we have. We know we have a problem, an environmental problem for the people living along the shore of Currituck Sound."

"It's become obvious to me we need your help. We need you to come down and see what we're talking about. And come in the right season. Come in the fall when Currituck Sound around Churches Island is like a septic tank, a cess pool. It's not fit to live near."

"Currituck Sound is Currituck County's greatest asset and Currituck Sound is sick," added L. C. Barrow. "It's sick and it needs help and it needs help beyond what we can do locally."

If funding is approved, UNC Sea Grant's first step toward helping Caroon and his neighbors will be to experimentally mow and harvest selected areas of milfoil next spring to study the growth and regrowth of the weed during a two-year period. Areas will also be sprayed with herbicides and studied.

Coping with milfoil...

(Continued from page 3)

Black plastic could be spread on the milfoil or black dye dumped in the water, but neither method is particularly practical for Currituck Sound, admitted ECU biologist Graham Davis.

A more promising, but still experimental, solution involves using natural milfoil predators. The white amur fish, for example, could be introduced in the Currituck Sound to eat away the milfoil problem. There is no guarantee, though, that the amur—a distant cousin of the minnow although it grows to over 100 pounds—would stop eating once the milfoil course was through. Similar problems exist with other natural biological controls like the paraponyx moth and sea cow.

At the same time, Sea Grant researchers will be exploring potential milfoil uses, studying the relationship of milfoil to water quality and determining the impact of milfoil on bass and other important species such as spot, bluegills and carp. The "edge effect" of milfoil will be investigated to see what happens to fish and plants when selected areas are mowed in the middle of a milfoil patch.

Finally, Sea Grant will try to attach some economic values to Currituck Sound and to the impact of milfoil and different milfoil controls, since any action would have to be justified in terms of money.

"Milfoil is probably doomed to failure," said B. J. Copeland, Director of the UNC Sea Grant College Program. "But the question is when will the failure occur and can we put up with it while it's here? If we are expected to deal with the problem, there has to be a gelling of what the problem is and what the choices of action are."

For a copy of the proceedings of the milfoil conference, write UNC Sea Grant, 1235 Burlington Labs, North Carolina State University, Raleigh, N.C. 27607.





Coinjock Ruritan Club spokesman S. E. Caroon

College status

Sea Grant earns an "e" for excellence

When S. E. Caroon got up and asked permission to speak, he said he had a tale to tell that folks"up in Raleigh" hadn't tuned in to.

Dr. B. J. Copeland, Sea Grant director, allowed as how he'd called the Eurasian Watermilfoil conference to give scientists, state-local officials, and coastal residents a chance to speak and listen. So, next day, Coinjock resident and Ruritan Club member S. E. Caroon approached the podium armed with letters and notes.

In all, Caroon and the others who spoke on milfoil gave the audience an earful of the problem which coastal residents and the Coastal Resources Commission had asked Sea Grant to explore.

Afterwards, some of the scientists and other professionals got together. They figured out what they thought it would take to combat and, perhaps, use milfoil.

Their plan is now part of Sea Grant's research proposal for 1977. If funds are approved this fall, Caroon and his neighbors will get some help.

"Sea Grant College just verified our own commitment to trying to solve relevant problems related to North Carolina's marine resources..."

Charlie Bass, who fishes out of Mackeys, is getting some help, too. Four years ago, no one in North Carolina much cared about eel fishing but Sea Grant advisory agents decided the state's eels would bring a high price on export markets. Bass and others took a liking to the idea. Last year, eeling brought fishermen \$600,000 and helped get a new company going. Related industries are estimated to have produced \$6 million in investments.

Private individuals and state officials alike got a promise from Washington last month that UNC Sea Grant would continue to listen to and help the Charlie Basses and S. E. Caroons of North Carolina. Secretary of Commerce Elliot Richardson announced that the University of North Carolina Sea Grant Program had been selected for Sea Grant College status.

The designation recognizes UNC Sea Grant for a job well done. It also guarantees stable and, probably, increased funding for UNC Sea Grant's coastal research and advisory activities. At the same time, it challenges university researchers and advisory agents to maintain their standards of excellence in identifying and meeting coastal problems head on.

UNC Sea Grant director Copeland believes the key to the program's success lies in the strong ties researchers, advisory agents and administrators have been able to establish both with the people of North Carolina and with state officials.

"Sea Grant College just verified our own commitment to trying to solve relevant problems related to North Carolina's marine resources. The success of the program has been and will always be due to the people who do the work, and to the relationship we have established and hope to maintain with state agencies, the university system, and the people."

(See "Sea Grant," page 6)



UNC President William C. Friday and Governor James Holshouser, Jr. at the Sea Grant College ceremony.

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Sea Grant graduates to college status

(Continued from page 5)

According to Bob Shephard, who heads up advisory services for the National Sea Grant office in Washington, North Carolina Sea Grant is recognized for particular strengths in:

—its recognition of and approach to regional problems;

—the excellence of its scientific researchers and maturity of its advisory services;

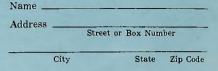
—and its ability to first identify problems and then "spread resources around" thus satisfying a variety of needs from coastal zone management to recreation advisory services.

Around the country, federal-state Sea Grant partnerships have been growing. There are now 17 institutional programs, 10 coherent programs and four more states are joining up. Sea Grant colleges are at the top of the organizational charts. To be considered for college status, an institutional program must be three years old, must have demonstrated an ability to get the job done and must include research, advisory services and education.

UNC now joins 10 other schools in Sea Grant College status. At those other schools, the recognition has helped them improve their programs, protected them from level-funding budget crunches (colleges are given preferential treatment), and given them political cudos within their state governments.

So what does all this mean to the people of North Carolina? According to National Sea Grant director Robert B. Abel, college status "is really the recognition of the meaning" that has already been demonstrated. It means that the University of North Carolina Sea Grant College Program will continue to strive to "close the loop," as Abel put it, to convey the results of scientific research to the people who can use the information—the fishermen, the seafood processors, the recreation industry, coastal residents, vacationers—those who use the state's coastal resources.

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UNIVERSITY OF NORTH CAROLINA



SEA GRANT COLLEGE NEWSLETTER

OCTOBER, 1976

1235 Burlington Laboratories NCSU. Raleigh, N.C. 27607 Tel; (919) 737-2454

The 200-mile limit: What does it mean to North Carolina?



Things might have turned out differently for Macon Meekins if Congress had been able to turn back the clock last winter when it passed the Fishery Management and Conservation Act of 1976—the 200-mile limit, or extended jurisdiction.

But, Meekins and other North Carolina fishermen who once made a living from river herring (alewives) have given up. In 1969, the river herring catch was 20 million pounds. But by 1975, it had dwindled to 5.8 million pounds. Foreign vessels working off North Carolina had overfished the river herring and depleted spawning stocks.

To Meekins and his fellow river horring fishermen, the loss amounts to roughly \$300,000 a year at today's prices and figuring on an average sustained catch of 12 million pounds a year.

Similar situations around the country led Congress to adopt the 200-mile limit which is designed

(See "Less foreign," page two)

Less foreign fishing means more fish for

(Continued from page one)

to put the brakes on foreign fishing, conserve stocks and make them available to U.S. fishermen.

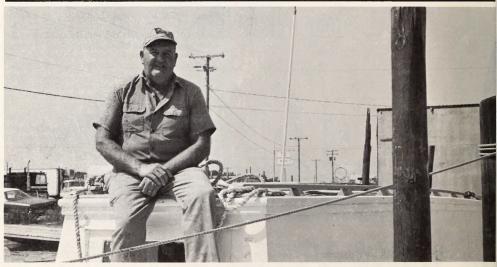
Meekins, now 51, works a long haul rig for croaker, spot, trout, bluefish and rock fish. "If it weren't for the trout, then I wouldn't be making as much money. I'm making as good a living as I was then, but we've been having warm winters. Them cold winters we don't make as much money."

In the days when river herring were "a big thing," says Meekins, "we didn't have trawl boats, no scallops. If we didn't have it now, we'd be in bad shape." As the state's fishing industry has grown, there have been increasing numbers of large trawlers fishing from South Carolina up to New England.

Those fishermen know what foreign fishing is all about, too. Gus Saunders of Wanchese saw foreign vessels "all the time" off New England "in school after school, this summer there were 80 or 90 fleets."

The foreign fishing is "just far superior to us for catching fish," according to Kenny Daniels of Wanchese. Larger 200- to 300-foot foreign boats, as compared with 100-foot or smaller American trawlers, are able to weather rougher seas, Daniels says. And, they have more sophisticated equipment. "We'd get 10 or 12,000 pounds a tow, they'd get 50 or 60,000 pounds. We're getting rid of our smaller boats and getting bigger ones."

It's these North Carolina fishermen, the ones who move farther offshore and north, who are likely to be affected by the new legislation first. After March 1, 1977, when the Act goes into effect, there should be fewer of the big, efficient foreign vessels and their accompanying factory ships in U.S. waters. And soon, there should be more fish available for American fishermen.



Macon Meekins, Wanchese—It seems as though in the last 10 years our herring industry has been decreasing. . The boys in Albemarle Sound don't catch them there

either. A lot of them's had to go out of the business. One fellow just tied his rig up and got him another job. It's just a thing of the past, herring fishing is.

.C. fishermen

Last year, an average of more than 500 foreign fishing vessels and support ships was sighted each month operating within 200 miles of the U.S. coast. On the East coast, the greatest fishing pressure has been off New England. But up to 200 vessels were sighted here off Oregon Inlet during the late 1960s and up until about 1972 when the river hering began to decline.

There have been concerns that foreign vessels would put more pressure on southeastern fisheries as those to the north were depleted. Then too, North Carolina wholesalers and fishermen looking ahead to a growing population expect the day will come when Americans, too, will have to learn to eat species such as squid which Spanish vessels now take off North Carolina's coast by the ton.

This year, foreign fishing off North Carolina is picking up. Spanish trawlers are taking squid and incidental butterfish. Japanese longliners are getting tuna and incidental swordfish and marlin. And, there is some activity in the remaining river herring, in lobsters, scup, sea bass, mackeral and others.

In general, though, "the situation over the past three or four years has improved," says Ed McCoy, head of North Carolina's Division of Marine Fisheries and one of the state's representatives on the South Atlantic Regional Council which will administer extended jurisdiction for this area. "We've been able to reduce generally the foreign take" through bilateral agreements with various nations and improved enforcement methods. But, McCoy says, the 200-mile limit is needed to give the U.S. complete control of all species in our waters. For North Carolina, that will mean a better chance for river herring to recover and an opportunity to limit foreign fishing here.

"The reaction is that there won't be any more foreign fishing. This isn't the case. We hope in the long term we can develop plans that will benefit the total fishery," McCoy says. The difference is that American fishermen will get first crack at a catch and only the predicted excess (where there is one) will be allotted to foreigners.

Extended jurisdiction is viewed in many states as the first step on the road to recovery for the fishing industry. For Macon Meekins and other river herring fishermen, that may be so for North Carolina as well. But also, the bill gives the state a chance to call a halt to things before they reach the critical point as they have elsewhere.



Gus Saunders, Wanchese—Foreign vessels off New England were in school after school. This summer there were 80 or 90 fleets.



Kenny Daniels, Wanchese—Our fish are being caught up and we're having to go to something else. I think we'll have to go to the things they're (foreign vessels) catching.

The fishery management and conservation act:

—establishes as of March 1, 1977, a 200-mile conservation zone which begins where states' three mile territorial waters end. Foreign fishing vessels will be required to obtain permits to enter the zone.

—covers 1) all fish within the zone, 2) all anadromous species (except highly migratory species such as tuna) throughout the migratory range of each species beyond the conservation zone, and 3) all Continental Shelf fishery resources beyond the conservation zone.

—authorizes some preliminary plans to be drawn up by federal agencies before March, 1977. Preliminary fisheries management plans affecting North Carolina include, among other species, billfish, pelagic sharks, river herring, shad, striped bass, spots, croakers, bluefish, scup, sea bass and wahoos. These preliminary plans are expected to form the basis of final management plans.

—sets up eight regional councils. North Carolina's representatives on the South Atlantic Regional Council (13 voting members from N.C., S.C., Ga., Fla.) are Ed McCoy, Division of Marine Fisheries; Bruce Lentz, N.C. Department of Administration; Norm Angel, N.C. Fishermen's Association.

—calls on the councils to submit and maintain management plans consistent with national standards for every fishery in the council's geographic area. Final approval of the plans is made by the Secretary of Commerce. If a council is unable to come up with an approved plan, the secretary can draw up his own, somewhat limited, plan.

—says fishery management plans must include: an assessment of both maximum sustainable yield (based on biological factors) and optimum sustainable yield (based on social, economic, ecological and biological factors) for each fishery; the actual proportion of optimum yield that can't be harvested by U.S. fishermen and can be made available to foreign fleets; consideration of recreational interests in a fishery; and the nature and extent of Indian treaty rights relative to a fishery.

-gives the councils discretionary power: a fish-



ery plan may 1) require permits and payments of fees for domestic fishermen, 2) designate areas where no domestic fishing can take place, or where only certain gear or types of vessels will be allowed; 3) establish a limited entry system to achieve optimum yield provided consideration is given to such things as historical fishing practices, the economics of the fishery, and the cultural and sociological ramifications of a limited entry system.

—sets national standards for the plans requiring that: management measures prevent overfishing; they be based on the best scientific information available; an individual stock be managed throughout its range as much as possible. Conservation and management measures are not allowed to discriminate between residents of different states. In addition, if an allocation plan becomes necessary, it is to be applied equally to all fishermen and not designed to give special privileges to any one individual or corporation.

—requires the councils to hold public hearings on the management plans.

—authorizes the Secretary of Commerce to issue permits to foreign vessels seeking to enter the 200-mile conservation zone. Comments on the applications are to be submitted by the appropriate regional council. Any citizen may submit to the council his or her comments about permit applications and the council must consider those comments in formulating its own comments for the Secretary.

—authorizes and funds the Coast Guard and the National Marine Fisheries Service (NMFS) to enforce the permit system within the 200-mile zone. Existing bilateral agreements are currently enforced by the Coast Guard and NMFS. Surveillance flights and boarding are expected to continue to be the major enforcement for the time being.

"A real bag of worms for the next couple of years..."

Almost to a man fishermen, processors, officials agree that something like extended jurisdiction is needed. But, as Norm Angel, one of the state's representatives on the South Atlantic Regional Council, puts it, "It's going to be a real bag of worms for the next couple of years."

The Act states that in the past "International fishery agreements have not been effective in preventing or terminating the overfishing of these

valuable fishery resources. . . . "

Fishermen tell of foreign violations they've seen. Kenny Daniels of Wanchese remembers a Spanish vessel in Norfolk which was carrying 2 to 3,000 pounds of illegal lobsters. Says Daniels, "A boat could come in, load up and be gone before anyone knew they had 'em."

Will the 200-mile bill be any different from previous treaties? Mike Street of the Division of Marine Fisheries reports that most interested nations are negotiating permits under the new legislation. If a nation violates the Act, the Secretaries of Commerce and State are authorized to bar U.S. sales of the nation's fishery imports.

As for the actual police work required to enforce the Act, Ken Harris at the National Marine Fisheries Service, one of the two enforcing agencies, says "Enforcement works a little better all the time . . . We've got quite a ways to go and we're getting there." Since 1967, 80 foreign vessels have been seized and fines of over \$10.7 million have been collected.

Of course, one of the crucial points in enforcing the Act is having something to enforce. Some observers are concerned that Optimum Sustainable Yield—with its biological, social, economic, and ecological considerations—will be a slippery thing to pin down. Jim Sykes, of the National Marine Fisheries Service which is to provide some of the technical backup for regional councils, says the capability is there to answer biological questions.

"We are standing by as biologists to do the research," he says. But "a lot of the data are not there." Some species are well understood, but others are not and no one is quite sure how information on age, growth, migration and so on will be collected.

Brian Rothchild, who heads up the national office of extended jurisdiction, says he expects uni-



Harry Fulcher, Atlantic—Oh my God, there's no comparison. They've got enormous vessels... Overall, all over the country, I think (the 200-mile limit) will be a big help. Always, with something like this you're going to have some areas that are more affected than others.

versities and federal and state laboratories will be advising the regional councils on specific stocks. And, at any rate, he adds, his office will provide what assistance the councils need. The councils will "not be left hanging on assessment."

And that leads to the larger question of who's minding the store. Some officials fear federal officials will take over, others wonder if the councils don't have just enough rope to hang themselves.

(See "A step," page six)

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A step down the road

(Continued from page five)

Still others are concerned about the Secretary of Commerce's role in having final approval of management plans. "It's almost a veto power," says Ed McCoy, a member of the South Atlantic Regional Council. "That is one of the things we don't like."

Rothchild says the role of the national office is to get the Act off the ground and then let the councils draw up plans and hold hearings. The councils have, he says, "a lot of leeway in that management."

Another unknown is exactly what species will be left for individual state management. SaysMc-Coy "We don't know what species will come under the Act." Depending on the interpretation of the law, McCoy says certain species, such as shrimp and menhaden, could ultimately be included in extended jurisdiction. Those species which should definitely not come under the Act, McCoy says, include oysters, bay scallops and other species centered primarily within the state's three mile jurisdiction.

Apart from limiting foreign vessels and their catches, how is extended jurisdiction likely to affect North Carolina fishermen?

It's really too early to say. Questions have been raised about the effect of possible increased quantities of fish in the marketplace and about the effect of controls imposed by regional councils on domestic fishing (some fishermen are arguing for mesh size limits). But that's farther down the road.

The South Atlantic Regional Council will start down that road at its first meeting in October.

We've tried here to scratch the surface of extended jurisdiction, to give readers a general overview. We'll all be hearing more about the 200-mile limit in coming months.

At Sea Grant, we would like to do what we can to keep people informed. So, if you have questions about the 200-mile limit, drop us a line at UNC Sea Grant, Box 5001, Raleigh, N. C. 27607.

Sea Grant's role

So what's Sea Grant doing to help?

Sea Grant programs around the country have been called upon by the Commerce Department's National Oceanic and Atmospheric Administration to examine:

- 1) socio-economic questions related to the 200-mile bill;
- 2) legal problems of jurisdiction in the individual states' territorial (3-mile) seas;

3) communications which involve the fishing community;

4) educational activities in fisheries management for extended jurisdiction.

Here at home, UNC Sea Grant is trying to develop socio-economic research capabilities to mesh with advisory activities. Then too, advisory agents and seafood specialists will continue to work with fishermen and seafood dealers on new, improved equipment and products.

University of North Carolina Sea Grant College Program 1235 Burlington Laboratories North Carolina State University Raleigh, N.C. 27607

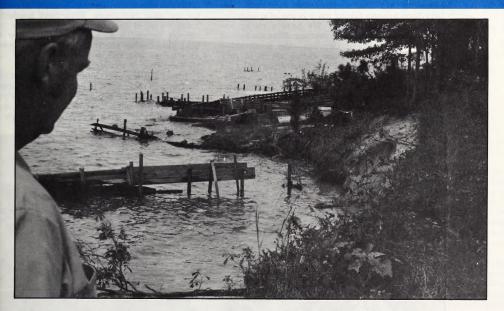


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Slipping Away: Erosion on the Estuarine Coast

Robert Leigh got a good buy on his shore front home. At least he thought it was a good buy until he discovered his 75 by 125 foot lot was slipping into Albemarle Sound.

"I've probably lost 30 feet in the last eight years," Leigh said. "What am I doing about it? Well, a man came the other day and estimated it would take \$3,000 to protect my property. I can't afford it."

So Leigh is dumping leaves and dirt and old logs in front of his home and hoping he can sell it before the next northeaster hits.

"I'm moving to the other side of the county," he

said. "I like the water and all but I can't keep dumping money into this."

Next door, Leigh's father-in-law Marvin Water-field is also fighting loss of his land. He has lost at least 60 feet in the last 12 years—and that in an area where a lot 75 feet wide by 150 feet deep sells for \$10,000.

Farther north, John Stallings, farm manager for Avoca Farms in Merry Hill, is facing a similar problem. And he's almost convinced he can't stop the erosion of the farm's two and a half miles of high shoreline.

(See "Sad Tales," page 6)

Rising sea level, sinking land, low topograp

The figures are startling.

For the past 18,000 years, erosion has been claiming parts of the North Carolina estuarine shore. An average of two to three feet is lost each year, with storms swiping up to 20 feet at a time: the U.S. Soil Conservation Service estimates that more than 60 million tons of earth have been eroded in the past 30 years.

"Basically, the entire North Carolina shoreline is eroding," according to East Carolina University (ECU) geologist Stan Riggs. "A few places are accreting, but that's ephemeral and local. The long-term process taking place is one of erosion.

"The reason is simple. We have a rising sea level—about one foot per century. Plus we have a good share of North Carolina—the northeast—which is sinking. A third factor which is very critical is that there is very low topography on most of North Carolina's eastern estuarine shore. This means that a very slight rise in sea level makes a very great change in elevation. With land that's only two feet above sea level, in 200 years you can see a tremendous effect."

Before North Carolina's mainland shores we considered prime property, no one worried mabout erosion. The loss of land was accepted "nature's way." But now with vacationers claning and paying top prices for second-home with water frontage, the estuarine shoreline more valuable. So when "nature takes its count and causes a little of the precious soil to sink low water level, there is quite an economic imp

Riggs, ECU geologist Michael O'Connor ECU biologist Vince Bellis have been looking estuarine erosion, with the help of Sea Grant fur for the past two years. They have tracked of 1,400 miles of the coast on their hardy ves "Sweet Agona," a 37 foot Chesapeake Bay oy boat named after the Indian maiden of "quest able looks" who fell in love with Beggar Ton the Lost Colony, much to his agony.

Riggs, Bellis and O'Connor have suffered sim hardship in their quest to understand the proces at work along the estuarine shores. They've I tled copperheads and uncooperative boat engibrayed mats of marsh and swayed through m



Old cars, hunks of concrete and even a kitchen sink have been used—often futilely—to slow estua erosion. A scene on the Neuse.

Recipe for erosion

storm as they explored every crevice of the coast ad mapped its features foot-by-foot.

The three Sea Grant researchers have learned a tabut how the coast protects itself from erosion, but people can do to help the coast protect itself d why certain areas are more vulnerable or sistant than others. By the time the three are rough next year, they hope to be able to tell local ficials and landowners in detail exactly what is ppening on the coast and why. An erosion insity scale—sort of a layman's guide to reading shore—is being developed to help people on the coast predict the erosion of specific areas and in for the future. Riggs, Bellis and O'Connor ope to be able to impart enough knowledge about rosion to let coastal residents work with an understanding of the shores.

Different rates for different banks

Riggs, O'Connor and Bellis have already dissered that different shorelines experience differstrates of erosion and they have identified some ajor shoreline types. The sand and clay banks clude low banks of one to five feet which are oderately to highly susceptible to erosion but can e protected fairly easily. High banks of five to 20 et may be extremely erosion-resistant if they're of the high banks are subject to the same sort of rosion as low banks. Bluffs rise higher than 20 et and erode somewhat more slowly. They lose more material per foot, though, and are very diffinit to protect.

Swamp forests have negligible erosion and sedithem therms are actually accreting. The area bewen swamp forests and low banks erodes less and the low banks but more than the forest. The rass marshes with their soggy peats are the most modable but they protect the sandy soils behind

Erosion of these shores is affected by numerous ther factors, which the researchers are still trying oursavel. So far, they've found that height, soil omposition, water depth and offshore topography front of the shore and the direction it faces all afluence erosion. The type and density of vegetation on and in front of the bank, the breadth of the ank and the size of the body of water the bank ces also affect the rate. Man's activities can hibit or encourage erosion.

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Eroding peat marsh

The options

"There's no way to stop this process, but you can slow it way down, so it's almost negligible to the landowner," ECU geologist Stan Riggs said. "One thing we're learning is that there is a whole series of different natural mechanisms which naturally slow erosion. Cypress, for example, can naturally produce a buffer against waves and catch sediment.

"One of the big problems is that most people who develop second homes are interested in clear views and a big swimming beach. So the first thing they do is cut down the cypress that block the view and clean up the grasses so they can have a sandy beach. Both the cypress and the grasses are natural protections. So pretty soon, the property is receding at a major rate, which is a major economic loss. So the people have to build a bulkhead, which is a major investment and which, had they understood the system, wouldn't have been necessary."

Another common mistake, according to the three researchers, is to clear the debris in front of an

(See "The Real Solution," page 4)

The real solution . . .

(Cont. from page 3)

eroding shoreline. The "trash" of fallen trees and branches breaks the waves and acts as a natural groin catching the sediment that erodes from the bank. It should be left, at least until some other type of bulkheading is made.

"Clean it up and you're costing yourself several feet of shoreline erosion," O'Connor said.

The shoals that often form in front of an eroding shore should also be left because they, too, slow erosion.

Sea Grant researchers are now looking at ways to copy the coast's natural protections. But the most common reaction to erosion—besides despair—is still to build a bulkhead. Between May 1975 and June 1976, requests for permits were made to build more than seven miles of bulkheading along North Carolina's estuarine shore—an investment conservatively estimated at at least three-quarters of a million dollars.

O'Connor, Bellis and Riggs have found that where built well and with an understanding of the process of erosion, bulkheading, sea walls, groins and other man-made erosion barriers are effective, especially on low-bank shorelines. They have also found, however, that bulkheads should be placed as planned units because the coast erodes in distinct geographic sections. Coves between resistant clay bluffs, for example, will erode together and should be treated as one shoreline. Otherwise, protection for just one part of the shore will only ensure greater erosion next door.

Advantages and disadvantages

Slowing erosion may make some landowners happy, but it also has its disadvantages. It may mean the loss of sandy beaches. Erosion provides the sand that makes the beaches in the estuaries, Riggs explained. Slow erosion and you risk cutting off the replenishing sand supply.

"Everyone wants a beach, but there's not a lot of sand in the estuaries. So at some point you can do yourself in."

Slowing erosion may also hurt the seafood industry since erosion of the peats in the marshes is probably an important means of recycling carbon and nutrients for the salt marshes. If you slow erosion too much, you risk cutting the productivity of the salt marshes which feed many of the commercially important seafoods which, in turn, feed the fishermen of the coast.

One answer to erosion problems is to "let 'er rip" and move development out of the way. Many counties are now trying to figure out "setback lines" beyond which it would be illegal to build. The problem with setbacks, according to O'Connor and Riggs, is that it is very difficult to choose the line since different areas of the coast erode at different rates. They hope their final information



A common error: clearing a stable shoreline and making it vulnerable.

will reveal where setbacks could be set since their data should show where development could occur most safely.

Still another suggestion is to make the natural erosion barriers—cypress headlands and fringe, resistant clay bluffs, swamp forest, peat marshland—areas of environmental concern under the Coastal Area Management Act. This would mean any development there would have to meet state guidelines.

"We're not taking any stands on whether to bulkhead or to let nature take its course," O'Connor said. "But we can show what is likely to happen in an area and assign success probabilities to different modifications. And we can provide an education for people which can allow them to make the right decisions. I've always maintained that people who are informed tend to make the right decisions."



Losing ground

Taking a hint from Mother

You shouldn't try to fool mother nature, but sometimes it pays to steal from her.

Sea Grant researchers Steve Broome, Ernie Seneca and Vince Bellis are taking nature's ideas for protecting the estuarine shores and experimenting with planting grasses and trees. They figured if it worked naturally, it would work with a little help from man, too. And natural protection would be less expensive than bulkheading, they reasoned.

"We've 'proved' it works, at least we've proved it works in some places," said NCSU soil scientist Broome. "And we say it usually costs less than \$1 a linear foot." Broome and Seneca have been planting marsh grass on eroding estuarine shores for the past two years. They have 11 test sites, some of which have been successful and some of which haven't.

Leroy Voris, is a Pine Knoll Shores resident who lives in back of an experimental *Spartina alterniflora* and *Spartina patens* patch facing Bogue Sound. The plot is working and Voris is extremely satisfied with the venture.

"It's been very gratifying. We were having some erosion, but we didn't want to bulkhead. We prefer the natural shoreline, as long as it doesn't wash away. The grass seems to be doing fine and we enjoy the big white herons that come in. There have been a lot more birds since the grass was planted."

Seneca and Broome also planted grasses near Uncle Henry's Oyster Bar at Masonboro Sound. The Army Corps of Engineers was having erosion problems in the intercoastal waterway there and wanted to try grass planting. So far, it seems to work.

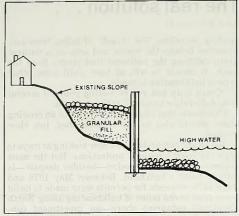
Doubly good

"By using a natural substance such as Spartina you accomplish two things at once," said David Frankensteen, a fishery biologist with the Corps. "Spartina is one of the most productive systems in the world in terms of energy and biomass and it provides detritus for all the little estuarine organisms which eventually go into the commercial fish species. So we're contributing to the detrital food chain as well as preventing erosion."

Seneca and Broome intend this year to find out what exact conditions are needed for *Spartina* plantings to successfully slow erosion.

Meanwhile, ECU biologist Vince Bellis is experimenting with using cypress and tupelo trees as natural erosion barriers. He has planted trees in the laboratory, in the swamps and on the beach. He has also planted on the beach behind inexpensive bulkheads to give the trees time to flourish. The lab plantings are booming, the swamp trees have all died and success varied on the beach.

Research is continuing.



A typical bulkhead

Bulkhead booboos

Bad bulkheads are easy to spot.

The purpose of a bulkhead is to hold soil to the shore. When bulkheads fail, it's obvious: the soil slips into the water and the bulkhead eventually follows.

Bulkheads generally fail by water eroding behind the wall either from the sides or the bottom. If the bulkhead isn't protected or placed deeply enough, water will dig under the wall and make it fall. Water in the soil behind bulkheads must be able to drain or the weight may push the bulkhead over. If the draining water isn't filtered, the soil will escape with the water leaving the bulkhead without any back support.

Bulkheads also fail when inadequate side walls allow water to cut behind and steal the back supporting soil. Inadequate tiebacks, or anchoring systems, can also make a bulkhead give. And if the wall material is too flimsy it can simply be broken by the waves.

So how do you do it right?

"You can't give a canned design that will work everywhere. A bulkhead is an engineering problem that needs to have an engineered design that is site specific," according to Jay Langfelder, engineer and director of the NCSU Center for Marine and Coastal Studies.

Building a bulkhead is expensive—costs range from \$20 to \$200 a linear foot—and many people cannot afford to add an engineer's fee to a small bulkheading project. Langfelder urges anyone building a bulkhead to choose a contractor with care. Walk around and see a few bulkheads he or she has built before.

(See "Bulkhead," page 6)

Bulkhead lore . . . helpful clues and an address for more

(Cont. from page 5)

It's also useful to know a "few things to think about" that can apply to any bulkhead project. The first thing to consider is what forces will be working on the bulkhead. How deep should the pilings be driven, what type and size pilings do you need? Do you need to add wing walls to avoid side erosion and how far back do they have to go? How strong must the wall sheets be? Do you need tiebacks? How many and how deeply should they be buried?

What materials will work best? Make sure you use corrosion-resistant hardware such as wrought iron and galvanized steel and be sure all wood is treated for use in the water.

And, again, always make sure a filter medium

Sad tales of erosion

(Cont. from page 1)

Stallings has tried planting exotic cypress and grasses and building jetties and still the shoreline recedes, dropping tons of soil into the sound.

"Nobody knows what we could do," he said. "A bulkhead would probably work but the cost would be prohibitive. You're talking about more than the farm would sell for."

The stories could go on for pages. There's the Lane farm in Perquimans County which has one of the highest rates of estuarine erosion in the state: it's lost 150 acres since 1950. Elsewhere, there's the old house pump sitting in the middle of the sound where a house once also sat. There's Batts Island which in 1749 had 40 acres covered with orchards and houses and is now reduced to a shallow shoal and a lonely cypress snag.

"Estuarine erosion is quite a problem," said Thomas Harrell, of the Chowan County Soil Conservation Service office. "It's a problem and if someone comes up with an answer for it, we'd like to know about it." is behind the walls. Filter cloth keeps the soil behind the bulkhead while allowing water to pass through. Be sure there are no cracks in the wall. Always be sure that heavy equipment is kept off the wall.

Understand what is happening to your shoreline before you begin work. Many homeowners overbuild their bulkheads while others seriously underbuild. And remember that portions of the coast are acting as units. Try to work with your neighbors or local government to get comprehensive shore erosion action.

For more hints on bulkheading write for "Help Yourself, a discussion of the critical erosion problems on the Great Lakes," available from the U.S. Army Corps of Engineers, 536 South Clark Street, Chicago, Illinois 60605.

Closer to home, Sea Grant has appropriated money for a coastal engineer to start work after the first of the year. We'll let you know when he or she is here and ready for questions.

Come one, come all

Three free workshops on an "Introduction to Aerial Photoghaphic Interpretation and Remote Sensing" will be held from 9 a.m. to 4:30 p.m. on:

Dec. 7 and 8—Marine Resources Center near Manteo

Dec. 16 and 17—Marine Resources Center, Pine Knoll Shores

Dec. 21 and 22—Marine Resources Center, Fort

For more information call Simon Baker at 919-737-2578.

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UNIVERSITY OF NORTH CAROLINA



SEA GRANT COLLEGE NEWSLETTER

DECEMBER, 1976

1235 Burlington Laboratories NCSU, Raleigh, N.C. 27607 Tel: (919) 737-2454



Minced fish. Frozen fish. Septic tanks. Erosion. Milfoil. Beach access.

Sea Grant's job is to help people get the most use out of their coastal resources without endangering those resources. Every, year, scientists, lawyers, economists and other researchers at the campuses of the University of North Carolina take a look at coastal research and advisory needs.

Proposals are made to meet those needs. After careful review, both by state agencies and the Office of Sea Grant in Washington, the University of North Carolina Sea Grant College Program draws up a plan of research, education and advisory services for the coming year.

So, here's our plan for 1977. Come January, researchers will take on erosion, milfoil, beach access and much, much more. It's an exciting year for us because the program, now in its seventh year of federal-state support, is expanding. Then, too, much of the research of the past year or two is wrapping up enabling us to head off in some new directions.





A common scene at the beach—increasing development.

Estuarine studies

North Carolina has 2.5 million acres of estuary. This area where salt water from the ocean mixes with the fresh waters of rivers and streams is the breeding ground of almost all the commercially important fish caught in the state.

The estuaries are also the scene of much human development. As more and more types of people and activities compete for the land and water, conflicts naturally arise. The environment of the estuary—and the economy of the coast—become threatened.

One way to keep track of the environmental health of the coast is through birds, which are easily affected by change. After several years of developing and perfecting their methods, Jim Parnell (UNC-W) and Bob Soots (Campbell College) are ready to make the state's first comprehensive bird census. This base-line data compared with future counts will make any changes apparent and warn state officials of possible serious environmental problems while there's still time to act. The data, including breeding bird populations, will be compiled in an atlas to be published by Sea Grant.

One environmental problem which is already obvious is pollution. About 472,760 acres of North

Carolina's estuaries are closed to commercial shell-fishing because of pollution and much of the blame is placed on septic tanks. Sea Grant researcher Bobby Carlile (NCSU) plans to continue demonstrating alternatives to conventional septic systems. He'll also identify the basic soil limitations for both conventional and experimental septic systems.

Shellfish waters are now tested for bacterial pollution, but Sea Grant scientist Mark Sobsey (UNC-CH) suspects that the present method doesn't spot viruses like the ones that cause hepatitis or polio. Through work with the State Shellfish Sanitation Lab, he'll learn whether the present testing is adequate. If it's not, he plans to suggest a practical virus test he's developed.

Up in Currituck Sound, Sea Grant researcher Graham Davis (ECU) will tackle the problem of Eurasian watermilfoil, an aquatic weed which is clogging boat motors, breeding mosquitoes, snarling fishing lines and emitting putrid odors when it rots in the fall. There are also questions about how milfoil affects the bass industry, water quality and public health. Davis, along with associates Mel Huish and Leon Abbas at NCSU, will look at the problem from several angles and suggest a solution that is practical and ecologically sound.

Food from the sea

North Carolina's sounds, bays and ocean teem with protein-packed life. About three per cent of the nation's commercial seafood comes from these waters, but processing in the state lags far behind. Researchers Marvin Speck and George Giddings, both of NCSU, are trying to help processors. Speck is looking for ways to increase the shelf life of seafood products and protect the good health of consumers.

Giddings is researching the effects of processing on trace elements and heavy metals in seafoods. His findings will be used to make recommendation on minimizing chemical contamination while assuring the best nutritional value of the product.

Another way to assist North Carolina's seafood industry is by introducing new products. To be successful, the new foods must be liked. So researcher Donald Hamann (NCSU) is looking at how to give new minced seafood products the popular texture of red-meat based foods.

Aquaculture is another logical way to expand North Carolina's seafood industry. Bill Rickards (NCSU) and associates have already shown that eels can be grown here in ponds. They'll continue to refine economic analyses of eel farming and provide technical information and help to potential eel growers and other scientists. They'll also gather biological and nutritional information on eels at the New Bern "farm."

Disease is an obstacle to many aquaculture ventures since it can spread quickly in confined aquaculture ponds and wipe out a "crop" in just a few days. Biologist Chuck Bland (ECU) has been studying fungal diseases affecting aquaculture and



Heading shrimp for marketing.

has provided some practical advice that saved many cultured shrimp and their growers. He'll continue to study the biology and control of fungal diseases and to help aquaculturists with disease problems.



Beach access is a growing problem.

Legal studies

North Carolina's beaches are open to the public. But with increasing development, it is increasingly difficult to get to those beaches. "No Trespassing" signs dot beach front houses. Fences spring up.

David Brower (UNC-CH) will tackle the thorny problem by defining, evaluating, testing and presenting the most effective legal tools which may be used by governments to secure public access to coastal beaches.

Coastal studies

North Carolina's coastline stretches over 330 miles. Over half a million people make their homes here. Where people and environment meet, problems sometimes arise. Eroding shorelines and continuing development are an obvious example.

Estuarine shoreline erosion gobbles up an average of two to three feet a year in North Carolina. But losses of 20 feet are not uncommon. Folks just can't afford to wait and see which backyards the land thief will gobble up.

For the past two years, Sea Grant-supported researchers at East Carolina University have been examining how erosion works and the factors that slow it down or speed it up. In 1977, Stan Riggs, Mike O'Connor and Vince Bellis will present local governments and land owners with a classification system of shoreline types and tips on identifying and dealing with those types.

There's more good news on estuarine erosion. Scientists working at North Carolina State University have proven that in some cases marsh grasses can be planted to slow and, sometimes, even reverse erosion. The problem is, the researchers can't readily predict where their grasses will and won't work. So, this year, Ernest Seneca and Steve Broome (NCSU) are teaming up with NCSU physical oceanographer Ernie Knowles in an effort to establish the physical and biological parameters affecting establishment of marsh vegetation.

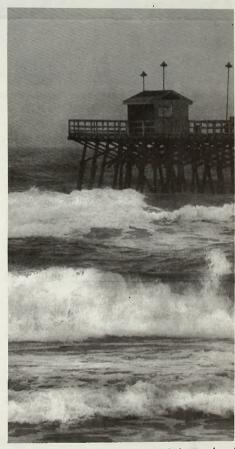
Of course, nature takes her toll on the barrier islands as well. Besides erosion, the barrier islands are faced with periodic oceanic overwash—when the sea rushes over the land. Bill Cleary and Paul Hosier (UNC-W) will map areas that experience overwash in varying degrees and explore whether and how vegetation can be a key to identification of potentially hazardous washover areas.

A close cousin to the washover, the inlet, will get a once-over by NCSU's Jerry Machemehl. He'll be developing predictive models for inlet behavior to help coastal engineers design inlets and predict the effects of man-made changes.

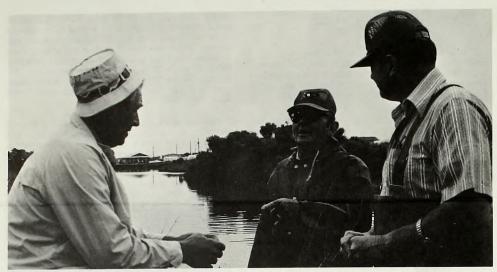
Another problem connected with increasing coastal development is sewage disposal. To tackle the problem, some people look to the sea for ocean outfall of treated wastes. Len Pietrafesa (NCSU) has been examining the circulation patterns off our southern—and rapidly developing—coast in Onslow Bay to predict where sewage dumped off-

shore might go. In 1977, John Bane (UNC-CH) and Pietrafesa will broaden the work to include the more northern—and very different—Raleigh Bay as well. Their research is part of work being done to solve this high priority problem by combining funds from the N.C. Office of Marine Affairs, the Energy Research and Development Administration, and the National Atmospheric and Space Administration.

Related work, to be done by Yates Sorrell (NCSU), will establish engineering criteria and define the site data necessary for the evaluation of a proposed outfall design. This, too, is part of the overall ocean outfall study.



The quirks of ocean currents are being explored to judge the effects of ocean dumping contemplated for the future.



Advising at the coast. Laft to right, Lawrence Lee Austin talks with advisory agents Hughes Tillet and Sumner Midgett about clam gardening.

Advisory services and education

A program like Sea Grant can't live in an ivory tower. Research findings have to be delivered to the people who can use them. And those same people play a key role in pointing out research needs. It's a two-way street.

Key to a smooth ride on that street are Sea Grant's advisory agents and specialists. Their job is to help the coastal public in any way they can. Advisory services in 1977 include:

Fisheries—Agents Sumner Midgett, Hughes Tillet (Manteo, 473-3937) and Skipper Crow (Morehead City, 726-7341) specialize in keeping fishermen informed of advances in equipment and business opportunities. They've worked with hydraulics, boat insulation, floating trap nets, clam and oyster "gardening," and the state's new eel fishery, among other things. A fourth agent, working out of Wilmington, will join them after the first of the year.

Seafood—Ted Miller, Joyce Taylor, Dave Hill and Keith Gates at Sea Grant's Seafood Lab in Morehead City (726-7341) take seafood the next step. They work with fish houses and processors on handling, plant design, product quality, new products and much more.

Land use management—Simon Baker (NCSU, 737-2578) specializes in assisting coastal governments with such diverse needs as planning, storm damage assessment, and aerial photography for delineation of coastal wetlands.

Recreation—New to our program in 1976 is Leon Abbas (NCSU, 737-2578). Abbas, an economist, is working on recreational business problems, marine recreation planning and policy.

Engineering—In 1977, a new and much needed specialist will join Sea Grant to help coastal governments and property owners with development and construction. This will include such engineering problems as bulkhead design.

Another way Sea Grant spreads the word and helps keep the public informed is through education

Because the state is facing increasing legal questions Tom Schoenbaum of the UNC-CH law school will be developing an ocean and coastal law program for the school. This will provide an opportunity for selected students to conduct legal research on particularly pressing problems as well as train future lawyers for the state.

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Update: extended jurisdiction

With implementation of the new Fishery Conservation and Management Act of 1976 coming this spring, the South Atlantic Regional Fishery Council—which will oversee extended jurisdiction off North Carolina—is hard at work. The Act, commonly called the 200 mile limit, will limit foreign fishing off United States coasts.

Meeting earlier this month in the Pine Knoll Shores N. C. Marine Resources Center, the group heard reports on research being done by the National Marine Fisheries Service—which is to provide major technical backup for the fisheries

management plans.

Mike Street, of the N. C. Division of Marine Fisheries, explained preliminary plans drawn up by the Northeast offices of the National Marine Fisheries Service. Those plans which would affect the southeast are: Atlantic herring, 35 million pounds allocated to foreigners; squid, 83 million pounds allocated to foreigners; hake (silver and red), 280 million pounds allocated to foreigners; Atlantic mackeral, 100 million pounds for foreigners; other finfish (including river herring, trout, croaker, spot, king mackeral, Spanish mackeral, porgy, snapper, grouper), 134 million pounds for foreigners.

Street explained that plans were only done on those species which the government would even consider allowing foreign fishermen to take. Haddock and cod were not done, for example, because no foreign permits are expected to be issued.

Additionally, Street said there were some problems with the plans, partially because, unlike northern fisheries, there is no good stock data available for most southeastern fisheries. Another problem, Street felt, was the lack of gear restrictions which could lead to increased by-catch. The council agreed to review the plans and make recommendations.

The council also considered a number of other questions ranging from the need for a flounder management plan, to limited vessel time for research work, to procedures for public participation in drawing up final management plans, to budget (\$857,000 for 1977), to the council's assignment to draw up a billfish management plan.

Five nations, including the Soviet Union, have now signed Governing International Fisheries Agreements with the United States under the new 200 mile limit. By signing, those nations agree to go along with the act and their fishermen will pay fees for fishing in U. S. waters.

The Council will open an office in January in Charleston, S. C. (the region includes North Carolina, South Carolina, Georgia and Florida), Also, an executive director is expected to be named next month.

One of the ways we try to keep people informed of Sea Grant activities is through this newsletter. Another way is through our annual report. The 1975 annual report outlines advances made by Sea Grant researchers and advisers last year (the 1976 report, of course, isn't at the printers yet).

If you'd like to receive our monthly newsletter or our annual report (they're both free), just fill in the form below.

Name	
Address	
Coastal interests	

University of North Carolina Sea Grant College Program 1235 Burlington Laboratories North Carolina State University Raleigh, N.C. 27607



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UNIVERSITY OF MORTH CAROLINA

SEA GRANT COLLEGE NEWSLETTER

JANUARY, 1977

1235 Burlington Laboratories NCSU, Raleigh, N.C. 27607 Tel: (919) 737-2454

Looking at seafood from the inside out

Microbiologists see things a little differently from most people. Where most folks look at fish or beef and think of dinner, microbiologists at North Carolina State University (NCSU) see potential problems.

"Anytime you start with raw foods, you're starting with a loaded situation microbiologically," explains NCSU food scientist Marvin Speck, the man who brought the world sweet acidophilus milk.

Speck and fellow scientists Bibek Ray and Cameron Hackney have been working with UNC Sea Grant to discover the microorganisms lurking in seafood and to find ways to keep the harmful ones out of the food we eat.

"In the seafood industry relatively little emphasis has been placed on this part of the industry, as compared to red meats and poultry. So really, we're starting at a very primitive stage as far as what is known," Speck says.

In addition, the North Carolina seafood business is relatively basic and very scattered. More than 100 handlers and processors operate in North Carolina and many are small family businesses.

"The more people you have handling food, the more people need education," Speck continues. "Combine that with a very sensitive food, like seafood, which is rapidly spoiled and you get a potentially explosive situation."

Recent explosive news about such things as mercury and kepone in fish has pointed out the need to know what other contaminants besides microbes are in seafoods. So NCSU food scientist George Giddings is looking at how processing affects both the heavy metal contaminants and nutrients in seafoods.

Speck, Ray, Giddings and Hackney don't confine their efforts to the laboratory. They are also very aware of the world outside the test tubes. The researchers continuously analyze samples from pro-



Scallop processing

Stalking the wild vibrio A quest for longer shelflife and better products

Headache, diarrhea, abdominal pain? All-around symptoms of Montezuma's revenge?

If the feelings begin after a hefty seafood dinner, Vibrio parahae molyticus may be to blame.

Vibrio parahaemolyticus is a small, curved bacteria which lives in most coastal waters. It's carried by fish and causes gastroenteritis when consumed in sufficient quantities. Vibrio is also the pathogen most often found in North Carolina's seafood, according to NCSU food scientists Marvin Speck and Bibek Rav.

"We've taken seafood from the coastal area and from local markets here and we've done more than 400 samples looking for indicators such as coliforms and plate counts and done some work looking for injured coliform. We've looked for pathogens such as salmonella, shigella, anaerobic toxogenies and vibrio," Speck says. "And what we've found in most cases is Vibrio parahaemolyticus is the main contaminating pathogen.

"Which is to be expected since it is a marine organism," he adds.

A new problem

Scientists on the east coast were surprised, however, when they discovered vibrio—which has plagued Japan for years—was a problem here.

"For some reason we thought the whole problem was a Japanese problem because they ate so much raw fish," Speck says. "Then in 1971 we had our first outbreak of food poisoning traced to vibrio in Maryland. From then on, after the methodology was developed, vibrio was detected about everywhere you looked for it in coastal waters. Now we think we have as much a problem as the Japanese."

The NCSU tests have shown vibrio in about 85 percent of the clams, 80 percent of the shrimp, 75 percent of the oysters, 30 to 40 percent of the sea scallops and varying amounts in finfish.

The amounts of vibrio were not always enough to cause trouble. But vibrio multiplies rapidly, and any mishandling of the seafood could raise the vibrio count to unhealthy numbers.

Fortunately, vibrio is very sensitive to cold and won't appear in water colder than 55 to 60 degrees Farenheit. So it's not surprising that it stops appearing in North Carolina seafood samples after about November and isn't seen again until about March.

Hard to detect

Unfortunately, according to Speck, vibrio often isn't seen anytime of the year using the conventional testing methods now used by the state and other regulatory agencies.

"We've found that the customary indicator, (fecal) coliform, cannot be depended on to find Vibrio parahaemolyticus," Speck said. "We think it's because this is a marine organism that it bears no relationship to the indicator organisms. So we

will have to look for this organism (vibrio) by itself."

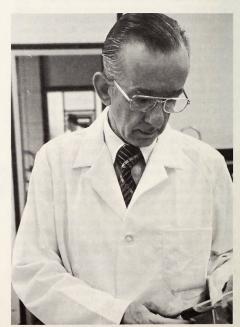
The most promising way to find vibrio—Speck and Ray have been developing the method with Sea Grant funds for the past two years—is called the repair method. Vibrio is sensitive to cold and heat and becomes "injured" when it is refrigerated or heated to a certain degree. But the injured bacteria remain harmful and can repair themselves.

Another approach

Using the new method—which determines the number of injured and uninjured bacteria—Speck and Ray have gotten very different results from the tests now recommended by the Food and Drug Administration.

"Where under the FDA method we'll find no vibrio, using the repair method there will be 43 to 200," says Hackney. "Or with FDA we'll find 23-100 and the repair method will find a 1,100 count. There's really that much of a difference. We think we have a very good method."

Once their study is complete, researchers plan to recommend their method to the state.



Marvin Speck

Heavy metals: elements to watch

Pollution means problems for the seafood industry. Already almost a fifth of the state's shellfishing waters are closed due to pollution. And attention is turning to possible new pollutants—like heavy metals—which may cause trouble in the future.

North Carolina's waters are in no danger from metal pollution now, according to Ford A. Cross, of the National Marine Fisheries Service (NMFS) in Beaufort. But a combination of factors compels scientists to keep an eve on the elements.

First, heavy metals can be harmful to man and marine life. Second, it appears that estuaries concentrate metals. It also seems that the metals are more toxic to young forms of marine life, making the estuarine "nursery" particularly vulnerable to increased metal levels. Metals occur naturally in the estuaries and are added through pollution. With developers and power plant builders—a source of many metal contaminants—eyeing the estuarine shores, many suspect pollution will increase.

Complicated

Heavy metals are also incredibly complex. Some lose their toxicity as the water gets dirtier, some—like cadmium—gain toxicity as salinity increases. Arsenic is less dangerous when it's "methylated" but mercury is more harmful in the methyl form. And copper, while as necessary to shellfish as iron is to man, can be lethal to larval forms.

To complicate things even more, different species of fish react differently to metals. Menhaden, for example, can tolerate much more copper than spot can.

And there are disagreements among scientists about whether heavy metals are even a pollutant.

"While we don't have a problem now, it's possible if precautions aren't taken and we don't stay on top of things, we could get into a mess," comments Bruce Fowler of the National Institute of Environmental Health Sciences.

Under Study

Cross and the NMFS are keeping track of how metals get into the estuaries and marine life and figuring out how the metals react and under what conditions they become toxic.

"Basically what we're trying to do is learn about metals so rational decisions can be made about them based on data," Cross says.

Over at NCSU, George Giddings is also staying on top of the heavy metals. Giddings, a seafood scientist with a bit of Boston in his speech, is using Sea Grant funds to find out how and why processing affects potentially harmful heavy metals and healthful trace elements in seafood.

Giddings is concentrating on shellfish since they get the most processing in North Carolina and are



George Giddings

an important part of the state's industry. Shellfish are also most prone to the effects of pollution since they are relatively stationary and live in the areas close to shore which are most easily affected by man.

Giddings has looked most closely at the calico scallop and found that, indeed, processing can affect the amount of metal in the food.

When the scallops Giddings studied entered a processing plant they contained essential trace elements manganese and zinc—which are important for human health. The scallops also contained cadmium—a heavy metal that can cause kidney damage in test animals and may be a carcinogen.

But when the scallops left the plant they were lower in both cadmium and the trace elements. Giddings traced the losses to the fluming method of transportation. And he says that with this information—and results from future tests—processors can change their methods to improve the nutritional value of their products and decrease the risk of heavy metal contamination.

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Getting the news to the people who need it

(Continued from page 1)

cessing plants at the coast. And anytime research findings point a way toward practical solutions to problems, they are quick to phone the Sea Grant advisory agents at the Seafood Lab in Morehead City.

From the Lab, the suggestions go straight to seafood handlers and processors, who are equally swift in putting the advice to work.

Sometimes the suggestions are as simple as ad-

vising people to clean their trash cans.

"In crab plants they have a process that virtually kills all the bacteria. No pathogens or indicators of pathogens are present," Hackney explains. "But after the crab has been handled by humans we're finding both pathogens and their indicators in the cooked, picked crab meat. We wanted to know how the crab was being recontaminated."

After considerable head-scratching, sampletaking and plant-viewing, Hackney thinks he may have the answer: the waste cans may be bringing in contamination after they are emptied.

"What's important is that we've established that the microorganisms aren't surviving in the cooked meat but are there afterwards," Speck says. "Now our job is to refine our focus so we can pinpoint the sources of contamination."

Another problem area which has been isolated by both Hackney and Giddings is the flume used to move scallops at some processing plants. Hackney has found that the final edible scallop muscle coming out of the flume, while still within legal limits, has a higher bacterial count than the whole scallop has before it is eviscerated or cleaned.

Why? One possible reason is that the flumes are dirty. Research will continue more easily on the causes, though, now that the site of contamination

has been identified.

Research in the lab has also shown some unsuspected plusses in seafood processing. After visiting several oyster plants and taking samples, Hackney found that the new heat shock method of preparing oysters—soaking the whole oysters in hot water for seven minutes to make the shell partially open—not only makes shucking easier but also cuts down on bacterial contamination and increases shelflife.

"The method wasn't developed for microbiological reasons, but it still kills surface contamination," Hackney says. "Of course, we want to go back and make sure they're not creating other problems with this process, but so far comparing the two processes the newer method gets a much better product."

"This whole field is very new," Speck adds. "But we do have a competence that has developed some new information that can be applied really more rapidly than I had anticipated."

Wanchese harbor

There will be a seminar series at the North Carolina Marine Resources Center on Roanoke Island on the upcoming Wanchese Harbor development. Sessions are open to the public and begin at 8 p.m. For more information, contact Jim List at 919-473-3493.

Jan. 27—Wanchese Harbor, a history

Feb. 3—Seafood, a commercial market Feb. 10—Estuarine ecology and the ef-

fects of Wanchese Harbor development

Feb. 17—What to do with the waste: the Wanchese solution

Feb. 24—Natural coastal processes and inlet stabilization

March 3—A harbor comes to town

March 10—Possible open panel discussion

University of North Carolina Sea Grant College Program 1235 Burlington Laboratories North Carolina State University Raleigh, N.C. 27607



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N. C.



UNIVERSITY OF NORTH CAROLINA

SEA GRANT COLLEGE NEWSLETTER

February, 1977

1235 Burlington Laboratories NCSU, Raleigh, N.C. 27607 Tel: (919) 737-2454

Septic tanks: hope for the coast

It was a pleasant surprise for Eddie O'Neal to read one day that there are alternatives to conventional septic tank systems.

It was almost a relief.

About a year ago O'Neal began trying to get approval to develop a marina in Swan Quarter. But

because his soil wasn't good enough for a conventional system—it wouldn't percolate—O'Neal was running into troubles with the permit-giving agencies.

"I talked to people in the state agencies and they said a septic tank won't work here. Well, I could see that. So I said, I know, but isn't there any other way? And they said 'No.'"

Then, O'Neal read a short article in the newspaper about a man at North Carolina State University named Dr. Bobby Carlile who is testing alternatives to conventional septic systems-alternatives that are especially geared for the problem soils of the coastal counties.

So the next time O'Neal spoke to the permit agencies he mentioned Carlile's work.

"I found it hard to believe, but they'd never heard of him," O'Neal said.

Undaunted, he called Carlile and explained his problem. Would O'Neal like to try an experimental alternative system? Of course, he replied.

"Dr. Carlile was looking for a place to try his system out: not strictly an experimental site, but one that would be in the real world and not under a control test situation," O'Neal said. "So I was helping him out and he was helping meprobably he was helping me a whole lot more."

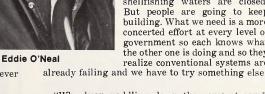
Through various negotiations, Carlile and O'Neal got permission to install an experimental mound system on O'Neal's property. Work will

begin as soon as the weather "dries up." The state will be closely monitoring surrounding waters to see how well the alternative system works. And O'Neal is required to have a back-up system for his two rest rooms in case the mound fails; he's planning on trucking his sewage to another system if the need arises.

But despite the complications, he's convinced that testing alternatives is the way to go:

"We've got septic systems in these coastal counties that are not working. Every year more shellfishing waters are closed. But people are going to keep building. What we need is a more concerted effort at every level of government so each knows what the other one is doing and so they realize conventional systems are

already failing and we have to try something else.



"Why keep paddling down the same stream? Why say there are no alternatives and you can't do anything?

"That will only make people frustrated and mad. And they'll try and sneak by. And that will hurt all of us.'

The search.

Tight clayey soils that won't absorb water plus a high water table that brings ground water almost to the ground's surface equal lousy condi-

MORTH CAROLINA STATE LIBRAR

tions for conventional septic tanks.

The lousy conditions prevail over much of North Carolina's coastal counties. In fact, a recent state study indicates that approximately 90 percent of the coastal area is unsuitable for conventional septic systems. The result is many failing septic systems which can pollute local wells and are implicated in the closing of much of the state's shellfish waters.

Almost one fifth of the state's shellfishing areas are closed due to pollution and less than a tenth of the pollution can be traced directly to sewage treatment plants. Septic tanks are usually blamed for the rest of the 400,000-plus polluted acreage. Other factors such as livestock runoff, migrating waterfowl and freshwater runoff also have an effect.

Failing septic systems can also create stinking messes and public health hazards. So health department officials responsible for approving small septic systems are leery of granting permits in

areas with poor soil conditions.

"People have property they want to develop and lots of times we have to turn them down. We hate to do this but we'd be causing a health hazard by approving them," says Ed Pierce, head of the Pasquotank-Perquimans-Chowan-Camden District Health Department. "I don't know what we can do for relief. That's where Dr. (Bobby) Carlile comes in."

Carlile and Larry Stewart are soil scientists at North Carolina State University who-with the help of UNC Sea Grant and N.C. Agricultural Experiment Station funds-are testing alternatives to conventional septic systems. Their alternative systems are now being monitored in Perquimans and Washington counties. More test sites are being arranged for Hyde, Pender and Carteret counties.

"What we're trying to do is develop home sewage systems that can be used in marginal or unsuitable sites. We know we're not going to have central sewage treatment for all areas of the state anytime soon (and the cost at the coast would be considerable), so we have to develop some kind of systems that can be used on any site," Carlile says.

"What we're looking for is systems that will work and that an average home owner can afford

and will use.'

The economic and health liabilities of failed septic systems are a major reason for the search for alternatives. But Carlile and Stewart also are thinking of agriculture when they look for septic

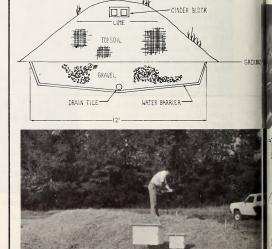
systems that will work on any land.

"To maintain prime agricultural land and leave it in production, you have to develop marginal land," Carlile explains. "Marginal farm land is also marginal for septic tanks, so you have to develop new systems that will work on this land."

If Carlile and Stewart are successful in finding septic systems that can work almost anywhereand the scientists are optimistic since their alternatives already appear better than conventional systems-the implications are large. Development would be possible in areas where it is now practically impossible. And that's a lot of land considering state estimates that approximately 90 per cent of the coastal area is "unsuitable for conventional septic systems."

"Most of us are resigned to the fact that this area will develop some way or another," comments Dr. Charles McCants, head of the NCSU Soil Science Department. "What we're hoping is the results from this research will help the area develop in a manner which will do less environmental damage than the current way.'

"There won't be any magic system to cure everything," Carlile adds. "Everything will have to be site specific and gradual improvement. But we can certainly do a much better job than is being done now."



Septic renovation levee: This test system serves two in houses in Plymouth, N.C. It is three feet high and 50 % feet long.

. . Shows the alternatives do work

What are the alternatives to conventional septic systems?

Best bets

—The renovation levee, or mound, system is one of the most promising for very poor conditions because the mound bypasses the local soil completely. Sand and other material are trucked to the site and built into a mound. Sewage is pumped to the top of the mound through a pipe. Treatment takes place above ground within the mound and by the time the effluent reaches the native soil it is treated.

Carlile is testing a mound in Plymouth at the Tidewater Research Station and plans to test

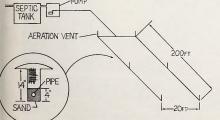
another in Swan Quarter this spring.

"We have enough data to say we can treat sewage with this system," Carlile says. "Our system isn't the optimum one yet; it needs improvements. But we think we know enough to do it better than it's being done (conventionally)."

Wisconsin and Pennsylvania are also experimenting with the mound system and Pennsylvania has actually installed about 2,000 home

systems while continuing research.





ow pressure pipe system: These one-inch perforated pipes are on a test site at Holiday Island, N.C.

Carlile estimates the mound costs from 10 to 100 per cent more than a conventional system, depending on shipping costs. The mound cannot be used in some areas. It needs much less space than a conventional septic system, but the space occupied is above ground. Carlile is experimenting with using a 40-foot to 50-foot long and 20-foot wide mound for several, perhaps as many as 10, homes.

- The low pressure pipe system is a good possibility for marginal sites. It relies on native soils, and is a promising option in areas where local dirt is okay but the water table is high at certain times of the year or there is a bed of clay. Sewage effluent is distributed over a large area through a network of shallow perforated pipes. This system needs a pump to bring the effluent from the tank to the lines. But it is still comparable in price to a conventional system. Its main advantage is that effluent is not concentrated in one area as it is in a conventional septic system. When a conventional system fails-even temporarily-pollution occurs in one intensified spot. Failure of a low pressure pipe system would be much less dramatic.

Six low pressure systems have been installed and are being monitored at Holiday Island, a second home development in Perquimans County.

Other options

— A shallow conventional system can work in areas with high water tables. A shallow conventional v-system has the added advantage of v-shaped walls which give about 40 per cent more surface area for absorption than the normal square walls.

Three shallow conventional systems are work-

ing now at Holiday Island.

— The dual field system is another modification of a conventional system. Two fields are installed and back each other up. If one field begins to fail it can be switched off for a rest while the second field takes over. And vice versa.

(Please see "We're," page 4)

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'We're definitely optimistic'

(Continued from page 3)

- The recirculating sand filter has gotten considerable attention in Illinois. This system uses a conventional setup plus an extra tank with a sand filter. The effluent moves from the first tank to the second tank, going through the sand filter and is circulated over and over, with fresh effluent being mixed with the semi-treated material. The final discharged material is supposed to be fully treated.

The sand filter system is an estimated two to three times more costly than a conventional system. There have also been problems with polluted

discharges.

 Aerobic systems are like small sewage treatment plants. Treatment takes place in the air instead of underground in a tank. But the effluent must still be discharged underground. This system can be two to three times as expensive as a conventional system and requires more maintenance. It may have applications for systems that have occasional failures, according to Carlile.

— Composting toilets are already manufactured and sold. They separate commode "black water" from the "grey water" of sinks, dish-washers, showers, washing machines and other water-using appliances. The composting toilet reduces the amount of water going into a septic system by an estimated 45 per cent, reducing the problem. Toilet wastes are treated separately in

a self-contained unit.

- Evapotransporation beds are another alternative-one best suited for dry climates. A very large sand bed is built, covered with topsoil and vegetated. Sewage is then introduced and, according to the theory, dissipated by evapotransporation. A test bed is now operating in Wake

County, North Carolina, but it's experiencing problems, according to Carlile.

"We're not really enthused with this system for this area (North Carolina)," Carlile adds. "It's got some tremendous problems where rainfall exceeds the amount of evapotransporation."

- The case system which uses a cinder block distribution system is being tested at Plymouth but doesn't look good for areas with a high water

table, Carlile says.

"I don't think we're ready to take the alternative systems and start putting them in everywhere there's a failing system," Carlile concluded. "But we feel confident enough to put them in with control conditions. And we can go to any site and make recommendations on modifications

that can be made to improve the site.

"We're a long way from an optimum system, but I think we're definitely optimistic," Carlile continued, adding that North Carolina is the only place he knows where people are actively working toward solutions to the coast's unique septic tank problems. "We've made improvements. We know our alternatives will work better than conventional systems. Now it's just a matter of making more improvements."

Want to know more about your present septic system? Sea Grant has produced a booklet "Your Home Septic System, Success or Failure?" that tells how to recognize and avoid problems. For your copy, write: UNC Sea Grant College, Box 5001, Raleigh, North Carolina 27607.

University of North Carolina Sea Grant College Program 1235 Burlington Laboratories North Carolina State University Raleigh, N.C. 27607



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UNIVERSITY OF NORTH CAROLINA

SEA GRANT COLLEGI NEWSLETTER

March, 1977

1235 Burlington Laboratories NCSU, Raleigh, N.C. 27607 Tel: (919) 737-2454

Ocean outfall:

The answer to coastal problems?

Winter moved slowly across the coast of North Carolina. At Nags Head, the wind whistled through rows of cottages that line the beach strand. They stood empty and ghost-like against the bleached sky.

Winter life was quiet in Manteo, too, where Joe Stokes works as Dare County sanitarian. But Stokes knows that the first warm breezes of spring have brought the tourists and summer residents who have made his county a thriving ocean resort. And the population will once again catapult from a winter average of 7900 to its peak summer total of 100,000.

The dramatic jump in population means prosperity for local merchants and developers. But for Joe Stokes it also means headaches. Not the least of Stokes' problems is the proper disposal of increasing amounts of human wastes.

Right now sewage is handled through domestic septic tanks-except in Manteo, where there is a municipal treatment plant. But Stokes foresees that within five years the septic tanks will begin to tax the land's ability to purify. When that happens development may come to a grinding halt. In addition, occasional high tides associated with storms sometimes leave in their wake flooded septic tanks up and down the narrow 35-mile stretch of Dare County's Outer Banks.

Stokes knows that some type of municipal wastewater treatment plant is in the cards for Dare County. And, like a growing number of North Carolinians, he believes that the solution to the county's problems may lie in the very resource that draws the tourists: the ocean. He is convinced that one feasible alternative for handling wastes is an ocean outfall—a pipeline stretching from the shore into the ocean. It would dump treated wastewater from several communities.

Dare County's problems are not unique. Similar dilemmas, in some cases more acute, plague officials in other coastal counties. In Pender County's

(See "There doesn't," p. 2)





'There doesn't seem to be any easy answer'

(Continued from p. 1)

Surf City and Topsail Beach, for instance, problems of sewage disposal have reached critical stages. In these areas, poor soil conditions for septic tanks are coupled with a high water table. That creates the potential for effluent and drinking water to become mixed.

New and more stringent septic tank regulations were passed for Pender County last November in an effort to curtail contamination of nearby shellfish waters. Other coastal counties will have to comply with new statewide septic tank regulations which go into effect in July. But Pender County sanitarian Penny Whiteside believes the county regulation is only a temporary solution. "There just doesn't seem to be any easy answer to any of it." he said.

Everette Knight, director of the Division of Environmental Management within the Department of Natural and Economic Resources, is familiar with Pender County's problems. "There is sewage coming out on top of the ground. And there is contamination of the shellfishing areas to the extent that they are being closed," he said.

Ocean sewage outfalls are now being seriously considered for the North Carolina coast for the first time. But the outfall concept is not a new one. Publicly owned outfalls are used all over the world -extensively in Hawaii, Australia, New Zealand and parts of Europe. Municipal outfalls for domestic waste dot the West coast of the United States. In southern California alone, five huge outfalls produce a discharge of nearly one billion gallons of sewage effluent each day. On the East coast, outfalls operate in Rhode Island, New York, New Jersey, Maryland and Virginia. Ocean disposal (sometimes of raw sewage) has been used on the Florida coast for years.

Until recently the EPA took a hard line against outfalls as a solution to waste disposal problems. North Carolina law still prohibits construction of ocean outfalls without the permission of the Division for Environmental Management. But, in a softening of attitude, director Everette Knight now endorses outfall research. "I think it's inappropriate to throw away any option that might work," he said.

But Knight believes that there are still many questions to be answered before any outfalls are actually constructed on the coast. A clearer understanding of the circulation patterns off the coast is needed to determine the destination of the sewage effluent once it is discharged into the ocean. Planners also want to know what effect the outfall discharge will have on marine life, commercial fishing and public health.

Debate on the subject of outfalls isn't limited to the hallowed halls of academia. It is an emotionally charged issue. Many coastal residents know of the problems created by outfalls operating in other states. Sewage effluent or sludge has washed ashore on many of the East coast's beaches.

Lucille Gore, mayor of Surf City, is one of those who is wary of the potential destructive power of outfalls. "The average individual is against it," she observed. "Lots of people around here are from other places, where they have seen dirty beaches.

Yet in the neighboring town of Topsail Beach, town councilman Mike Boryk expresses different views. "Our feeling here is that we ought to go to ocean outfall. The land surrounding us is not suitable for land disposal," he said.

In Dare County, sanitarian Joe Stokes contends that an outfall would be "like a spit in the ocean." Preliminary hearings have already been held on a proposed ocean outfall in his county. But Stokes expects a hew and cry from some local citizens once the plans are further developed. "I'm afraid we're going to have a mental block about the sewage going into the ocean," he said.

Dare County May Be N.C. Test Ground

Dare County may be the first testing grounds for an ocean outfall in North Carolina. Two years ago the Dare County Board of Commissioners began grappling in earnest with plans for a municipal sewage treatment plant for the larger communities in the county. In October 1976 a proposal to study the possibility of an outfall in the county was completed by Henry von Oesen Associates, a Wilmington engineering firm.

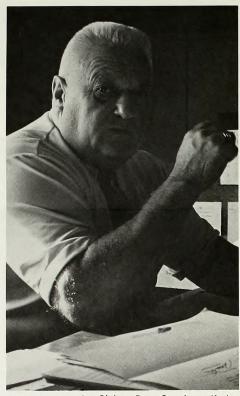
William E. Burnett, one of the firm's engineers, is convinced that Dare County is one of the best sites for an outfall in North Carolina. "There is no other way of disposing of the wastewater in Dare County that is environmentally sound and cost effective." he said.

The engineering firm's study plan has now passed the approval of the state's reviewing agency, the Division of Environmental Management of the Department of Natural and Economic Resources. Dare County officials are waiting for EPA approval before they proceed with the study. Once the final study is complete, approval of both agencies will be required before actual construction is begun.

The preliminary plan calls for construction of an outfall which would ultimately serve Kitty Hawk, Nags Head, Kill Devil Hills, Manteo and the Wanchese Harbor fisheries complex. According to Burnett, the outfall would be built either in Nags Head or Kill Devil Hills. The plan is based on a projected flow of 3.5 million gallons of treated wastewater per day for the year 1990. The outfall pipe would reach out into the ocean about a mile and discharge would be into 45 or 50 feet of water.

The tentative plan also proposes that domestic sewage be treated to a secondary level at a treatment plant located on about 15 acres of land near Kill Devil Hills. Secondary treatment removes about 90 percent of the suspended solids from the wastewater and the majority (but not all) of the bacteria and viruses.

In selecting an ocean outfall as the most promising plan for Dare County, the engineering firm rejected three other alternatives commonly used in the United States. One possibility would be to discharge the wastewater from a regional treatment plant into the estuarine waters of the Currituck, Albemarle or Pamlico Sounds. The water in those areas, Burnett points out, is shallow. Disposal of sewage into the sounds could eventually upset the balance of plant and animal life in the estuaries.



Joe Stokes, Dare County sanitarian

Burnett also fears that the discharge might aggravate the problem of milfoil, an aquatic plant whose rapid growth has clogged parts of Currituck Sound. And, finally, Burnett was concerned that pollution of the estuaries might mean the closing of more of the state's shellfishing waters.

A second alternative, land disposal, would involve spraying treated wastewater over about 900 acres of land. Peat soils and a water table that is almost at the soil's surface make the land on the mainland of Dare County unacceptable. About 85 percent of the land on Dare County's Outer Banks is environmentally sensitive park land. Burnett was unable to find a suitable area large enough for land disposal on the islands. He felt that using several smaller plots would have made the cost of the project prohibitive.

A third option which has been unsuccessfully tried once in North Carolina is deep well injection. It requires piping treated wastewater into wells drilled into the earth's surface. Since 1973, North Carolina law has prohibited deep well injection. "You really don't know what happens to the effluent and whether it might mix with drinking water," said Burnett.

Scientists tackle tough questions

Several Sea Grant researchers are among the North Carolina scientists who are taking a look at many of the tough technical questions that need to be answered about ocean outfalls.

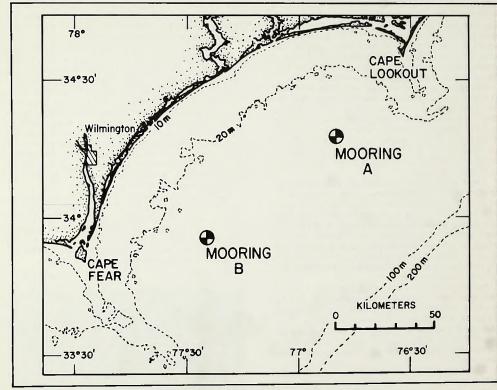
Sea Grant is funding three projects this year which are related to the issues of ocean outfalls. In a project supported by the EPA and the North Carolina Department of Natural and Economic Resources (through the Water Resources Research Institute), researchers will be looking at the options for water management in coastal North Carolina. One of the aspects of the study will be an analysis of the possibility of ocean disposal of wastewater. Studies will be made of population trends, available water resources, water requirements, and laws. Researchers will also be taking a look at the sociological and political problems involved with water management. The study will concentrate on the Dare County Outer Banks and Morehead City-Carteret County areas.

One other project now in the works is a comprehensive study funded by the Coastal Plains Re-

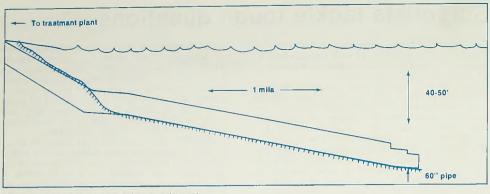
gional Commission (CPRC) and the Department of Administration's Office of Marine Affairs (OMA). The two year project, which got underway in January, is a landmark study of the East coast. Scientists working on the project will be taking a general look at the feasibility of placing an ocean outfall off the North Carolina coast. They will study the engineering of outfalls and their potential effect on marine life and public health.

One of the first questions to be answered about outfalls is how the sewage effluent will be mixed in the ocean waters and where it will go. With the aid of Sea Grant funding, Dr. L. J. Pietrafesa of NCSU has been studying the circulation patterns of the North Carolina continental shelf for the past three years. Pietrafesa has stationed complex moorings 40 to 150 miles out in the ocean to collect data on water temperature, salinity, currents and winds. He is doing intensive studies of the circulation in Onslow, Raleigh and Long Bays.

Results of Pietrafesa's 1975 study of Onslow (See "Circulation, design," p. 5)



Two mooring locations being used in Pietrafesa's circulation studies of Onslow Bay



Ocean outfall: one design being considered

Circulation, design, impact scrutinized

(Continued from p. 4)

Bay indicate that there is a strong onshore flow which could bring effluent to the beaches of the area. Because of strong wind forces, the shape of the bay and shallow water, Pietrafesa feels that it will be difficult (but not impossible) to predict the exact flow of outfall effluent. "On a coastline like this, it has to be handled gingerly," he said. Pietrafesa's early results from Raleigh Bay show that there may be a predominant northeast flow.

Pietrafesa is sharing data with scientists from the University of Miami and Skidaway Institute of Oceanography, who are now studying circulation off the coasts of Georgia and Florida. Information from an intensive research project in the Virginia Beach, Virginia, area is also proving to be valuable to North Carolina researchers. An ocean outfall for the Virginia Beach area is now in the design stages.

Yates Sorrell, a mechanical and aerospace engineer at NCSU, is heading the engineering and dispersion modelling section of the CPRC/OMA project. Sorrell is trying to determine the most effective means of pumping treated wastewater and the best system of dispersing the effluent into the ocean waters. He and several other scientists will be attempting to come up with a method of analysis that can be used to determine whether an outfall will be acceptable.

Sorrell is also working on a Sea Grant project this year which includes an analysis of the hydraulics of an outfall and diffuser. The information gathered will be used to develop criteria or requirements for outfall locations and diffuser designs. Sorrell will be considering the chances of outfall discharge returning to the beaches along the coast.

There are present in treated wastewater pathogenic bacteria and viruses which could affect marine life and public health. Dr. William Queen

of East Carolina University is heading the CPRC/OMA project's biological studies. During the first year, biologists will take stock of the literature that is already available on the effect of ocean outfalls on marine biota and public health.

Dr. Mark Sobsey, a virologist at UNC-CH, points out that sea water is a hostile environment to many of the microorganisms and viruses in sewage. The rate at which the harmful organisms die off depends upon the water's temperature, salinity and type of marine life present. In order to determine the die-off rates, Sobsey will select water from several locations off the coast. During the first year of the study die-off studies will be confined to the laboratory. Water collected at several locations off the coast will be contaminated with known quantities of sewage and sediment. The laboratory results will be tested in the sea water environment the following year.

Sobsey is collaborating with Dr. Bobby Carlile and Dr. L. D. King of NCSU to develop alternative on-site septic waste disposal systems that can be used in the coastal area. This Sea Grant project, headed by Carlile, is in its second year. Two alternative systems are now being used experimentally in several coastal counties.

(See "Effects on," p. 6)

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Effects on ocean life also examined

(Continued from p. 5)

Scientists are concerned about the effect of sewage on the economically important shellfish industry in North Carolina. At the present time, nearly one quarter of the state's shellfishing waters are closed because of high levels of contamination. With Sea Grant funding, Sobsey will be working with Dr. Marvin Speck of NCSU and the N.C. Shellfish Sanitation Laboratory to determine what impact sewage might have on shellfish. They will be experimenting with oysters and clams collected from 12 locations off the coast. Sobsey is developing and evaluating more effective methods for detecting enteric viruses in shellfish.

Also of interest to the biologists connected with the CPRC/OMA project are the effects of an outfall on fish in their larval stages. Queen points out that many species of fish spawn in the ocean. Their larvae move back into the estuaries where they mature before returning to the sea. If it is found that the larva are particularly vulnerable to outfall contaminants, fish populations could be adversely affected.

Off the presses

A Flow Study of Drum Inlet, N.C. by Paul R. Blankinship

A Very Special Fish: American Shad by Joyce Taylor

Fishery facts at your fingertips by Freda A. Ramey

The Dune Book: How to plant grasses for dune stabilization by Johanna Seltz

Residents of North Carolina may receive a copy of each publication free of charge. Available from Sea Grant, P.O. Box 5001, Raleigh, N.C. 27607.

Continental Shelf symposium set

The first Continental Shelf Symposium will be held at NCSU March 30 through April 1. Dr. Ernie Knowles of NCSU is collaborating with other Sea Grant-supported scientists in planning for the symposium.

The conference is a cooperative project being sponsored by Sea Grant, the NCSU Center for Coastal and Marine Studies and the Coastal Plains Center for Marine Development Services.

Twenty-five invited papers will give a state-ofthe-art explanation of all the natural processes on the Continental Shelf. Development pressures for sewage outfalls, nuclear power plants, deep sea oil terminals and dumping have centered on the Continental Shelf. But it is still one of the least understood areas.

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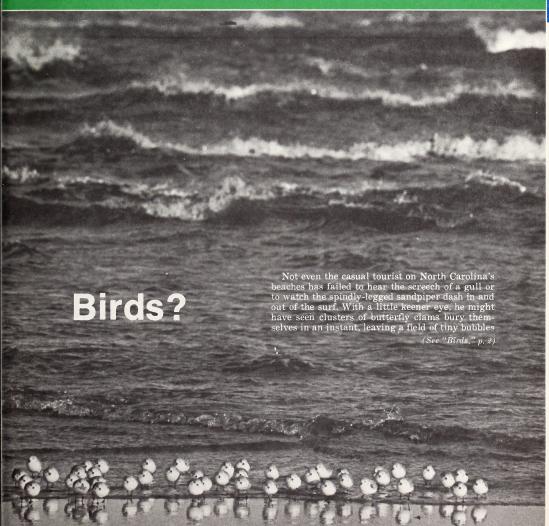
UNIVERSITY OF NORTH CAROLINA



SEA GRANT COLLEGE NEWSLETTER

April, 1977

1235 Burlington Laboratories NCSU, Raleigh, N.C. 27607 Tel: (919) 737-2454



Coastal Birds: Enviornmental Barometers

(Continued from p. 1)

in the wet sand at the water's edge. And if he has strolled the beach at night, he has probably watched ghost crabs scamper across the sand in their nightly feeding rituals.

For the beach lover, these creatures of the sea and sand are an integral part of the coastal magic. To the naturalist, they mean something more. They are environmental barometers—indicating just how man and his development are affecting the delicate balance of nature in the coastal region.

Birds are among the best environmental barometers. Because they are easily affected by any kind of contaminants, they quickly reflect environmental problems. And they are relatively easy to observe.

"Birds are probably the most visible animals we have. If changes are occurring in a bird population, even an amateur ornithologist might notice it." That's the contention of Dr. Robert Soots, an ecologist with Campbell College.

Taking the census

Along with Dr. James Parnell of UNC at Wilmington, Soots has spent the past four summers carefully noticing North Carolina's coastal birds. Until they began to take a census of the state's coastal birds last summer, population figures had been little more than educated guesses. When Parnell and Soots finish their Sea Grant-supported work this summer, they will have established a count which can serve as a baseline for future reference.

Late this month, many species of colonial birds (those that nest in groups) will begin nesting. In May, Parnell and Soots and eight or 10 graduate students will take to the field and begin the laborious task of counting. They will use aerial photography to count some species, such as Royal Terns and Black Skimmers. For other species, the task calls for crawling through brush and climbing trees.

In the smaller colonies, of no more than 2000 birds, the census is taken by actually counting each nest. Because the birds nest in pairs, the researchers double the number of nests to get the

total number of adults in the colony. A counting crew visits each colony twice between the period of maximum laying and hatching for that particular species. Birds that habitually nest together—such as the Sandwich Tern and the Royal Tern—cause added difficulties for the census takers. Their laying seasons may be radically different.

In larger colonies, Parnell and Soots may use the strip census. All the nests within a certain diameter strip are counted. Soots adapted another technique used widely by foresters to measure volumes of timber. Called the point center technique, it seems to work if the nests in a colony are randomly scattered throughout the site.

'Heronries are a fit'

But it is not always easy going. They have found no suitable method for estimating the heron population. "The heronries are a fit," said Parnell. "They are absolute chaos. You might have nine different species in two dimensions. You have to climb trees and crawl on your hands and knees."

To make matters worse, young herons will regergitate on anyone who disturbs them. And there are two or three types of herons sometimes nesting together whose eggs are too similar to distinguish under field conditions. The counting process is compounded by the problem that if the adult birds are frightened away from their nests for long periods of time, the eggs may become overheated from exposure to the sun. So the counting in colonies where adult birds are likely to leave their nests must be done within an hour. That group includes most of the birds who nest on the ground.

Last summer Parnell and Soots counted 11 species of long-legged waders—the herons, egrets and ibises. The most common bird in this group was the White Ibis, which had about 3000 nests. The Louisiana Heron and the Cattle Egret weren't far behind, with about 2700 and 2400 nests respectively. About 90 percent of the total of 27,000 birds in this category nested in man-modified sites, mainly on dredge islands.

(See "Census-taking," p. 6)



Clockwise:

Nest in an Emerald Isle heronry Bob Soots and Leon Jernigan taking a census Common tern eggs in nest White Ibis on Battery Island









The plight of the least tern

The bird that is causing ornithologists the greatest concern on the North Carolina coast now is the Least Tern. The smallest of the terns, the Least Tern habitually nests on the beaches, where it is exposed to the hazards of encroaching development, tourists and fishermen.

This little bird seems to be suffering all over the country. One race of Least Terns on the West Coast has already been placed on the California and federal registers of endangered species. In North Carolina, the Least Tern falls into the official category of special concern, which is one step short of a threatened species.

Leon Jernigan, a graduate student at NCSU, is rapidly becoming North Carolina's expert on the plight of this bird. Jernigan has been working with Sea Grant-supported researchers Jim Parnell and Bob Soots to study the size of the Least Tern population. He is also studying the bird's requirements for suitable nesting sites. When he completes his research this summer, Jernigan expects to be able to propose management techniques that might increase the size of the colonies in the state.

The Least Tern requires a bare, sandy area with little or no vegetation for nesting. In the past it has nested largely on the barrier islands and coastal beaches. It has been slower than many other species to turn to the safer habitats on dredge islands. But now an estimated two-thirds of the population nests on dredge islands. There are more suitable dredge islands that are not being used, Jernigan points out.

The Least Tern is most vulnerable during its nesting season, which can stretch from the first of May until the end of July. The female usually lays two inch-long eggs directly on the sand. The eggs have a 19- to 20-day incubation period. It is 21 days before the hatched fledgling can fly. Because they are well-camouflaged, the eggs and the young are often destroyed by vehicles and people.

Like many other birds, adult Least Terns will fight to protect their nests. Though they will leave their nests when frightened, they often dive at or excrete on people who disturb them. Such defense methods are ineffective when the enemies are the four wheel drive vehicles driven on the beaches. In recognition of this problem, the U.S. Park Service posts signs at the Cape Hatteras National Seashore which read: "Terns Nesting: Do Not Disturb."

Jernigan also points out that pets can be a problem for nesting terns. One dog could easily wipe out a colony of 15 terns, he said. In rare cases, vandalism is the cause of a colony's ruin. Sometimes people collect the eggs they find lying on the



Least Tern fledglings are well-camouflaged in their sandy nest.

sand. "Most people have a concept that birds nest in a tree in a regular nest. I don't think they realize that an egg in the sand can be a nest, too," Jernigan said.

Foul weather hits the Least Tern hard. Last summer's rains took heavy tolls among the colonies. Many nests were washed out and adult pairs laid as many as three separate sets of eggs in an effort to reproduce.

Last summer Jernigan counted about 1500 nests in 79 colonies on the coast. He believes that figure may be somewhat inflated because some colonies moved and may have been counted twice. Still, it's a low figure when compared with statistics on other terns. The population of adult Royal Terns, for instance, was about 17,000 birds—in only seven colonies.

The Least Tern has had a rough history in the United States. Along with several other birds, it suffered a severe decline in the late 1800s when it was hunted widely. Its plumage was popular for ladies' hats. At the turn of the century a law was passed prohibiting killing of the birds.

Jernigan believes that a few compromises on the part of people who use the coast would aid in the Least Tern's recovery. Four wheel drive vehicles would do very little damage to the colonies, he contends, if people would drive them only on the first berm of the beach. Colonies usually nest against or behind the dunes. He also suggests that known nesting sites be posted during nesting season and that, if possible, traffic be routed around them. Dredge islands now being used by Least Terns must be maintained so that they do not develop too much vegetation.



Stalking the ghost crab

For the past three summers Tom Wolcott has been chasing ghost crabs up and down the beaches of North Carolina. Armed with a transistor radio and a starlight telescope, he works from dusk to dawn.

Wolcott, assistant professor of zoology at North Carolina State University in Raleigh, developed a consuming interest in ghost crabs (Ocypode quadrata) when he moved to North Carolina five years ago. "The question I asked in the beginning was 'Just how important are these guys?' "he explains. In order to find out, Wolcott had to determine what the ghost crabs eat.

"So I spent a lot of time walking up and down the beach stalking every crab that was eating and then stopping to see what he was eating," said Wolcott.

These strange antics have resulted in some surprising discoveries about the ghost crab's place in the food chain of the beach. Wolcott contends that the ghost crab is not the scavenger it was once believed to be. Until recently, it was assumed that ghost crabs picked their meals from rotting seaweed and trash which washed up high on the dry sand.

But Wolcott believes that the crab disdains such fare. What he found after many nights of observation was that these creatures spend all their feeding hours below the drift line, digging for the other two crustaceans on the beach—the coquina (butterfly clam) and the emerita (mole crab). In fact, Wolcott's studies have shown that the ghost crab consumes half or more of the population of both species. That makes it the biggest predator on the North Carolina beaches.

The ghost crab probably got its name from its habit of scampering silently across the beach at night and disappearing into a hole in the sand if threatened. During the day crabs stay in their individual burroughs underground. At night they come out to feed.

Early in his studies, Wolcott did a burrough census and discovered that the crabs are very numerous on North Carolina's beaches. During the summer months as many as 20 crabs may inhabit a one-meter wide swatch of the beach from the dunes to the ocean. "That's dull work, I tell you—counting every hole on the beach," Wolcott observed.

So far, most of Wolcott's work has been done on 50-meter wide stretches of beach at Shackleford Banks and Ft. Macon State Park. During the summers he relocates at the beach, using an office at the Marine Fisheries Lab in Beaufort. He takes with him his research vessel, affectionately called the "RV Sears," a 12-foot plastic boat.

But more important than the boat in his tracking of crabs are the tiny transmitters Wolcott makes. At about dusk on observation nights, he traps two or three crabs and tapes the transmitters to their backs. The equipment gives out rhythmic signals which Wolcott picks up on his souped-up transistor radio. Perched high on a dune, he can locate the crabs and observe them with his starlight telescope. The telescope amplifies light so that he can see the crabs from a distance.

"You can drive yourself crazy doing that. One crab may go 300 meters one way, while another scampers 100 yards in another direction," said Wolcott.

The ghost crabs do not seem to have any natural predators on the North Carolina beaches, though they are occasionally cannibalistic. Wolcott suspects that racoons might be interested in eating ghost crabs, but he can find no racoon tracks on the beach.

This particular species of crab ranges from Rhode Island to Brazil. The top weight of crabs in

(See "Ghost crabs," p. 6)

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Ghost crabs: Beach predators

(Continued from p. 5)

this area is about 40 grams. If an average-sized crab (about 20 grams) is allowed to eat all it wants, it would consume two grams of meat per day. That's the equivalent of one good-sized emerita or about a dozen coguinas.

One of the most startling pieces of information that Wolcott has uncovered has to do with how ghost crabs obtain water. After October the ghost crabs disappear from the beaches. Their burroughs close over with sand and they don't bother to dig out again until May. Nobody knows exactly what happens to them.

Wolcott contends that they don't eat during this time. But they must have water. In testing the crabs, he discovered that they can get all the water they need from the moist sand. They use their setal tufts to extract water and then suck it into their brachial chambers.

"They are sucking, which we all know crabs can't do." chuckled Wolcott.

Census-taking will Result in bird atlas

(Continued from p. 2)

The census revealed 12 species of ground nesters in the coastal area. There were 76,000 birds all together and about 83 percent of them nested on dredge islands. The most abundant of these was the Royal Tern, with over 16,000 nests. The most rare was the Great Black-backed Gull which is just beginning to nest in North Carolina.

Parnell and Soots have also found some surprises in their research. Until they started work, no one knew that there were any Herring Gull colonies in North Carolina. The researchers discovered a colony of over 300 pairs of birds. Forsters Terns, Caspian Terns and Great Black-backed Gulls were also recorded for the first time in North Carolina.

An abnormal amount of rain on the coast made last summer a difficult one for birds and ornithologists. Many of the birds that nest on the beaches were repeatedly washed out. "A lot of herons died last summer. We found the young dead of exposure by the dozens. They just can't make it in wet weather," Parnell noted.

Parnell and Soots are hoping for average weather this summer so that they can complete their census. They will compile the final statistics into an atlas of maps, pinpointing the locations of various colonial bird colonies on the coast. The maps will be valuable for local governments, developers and bird lovers.

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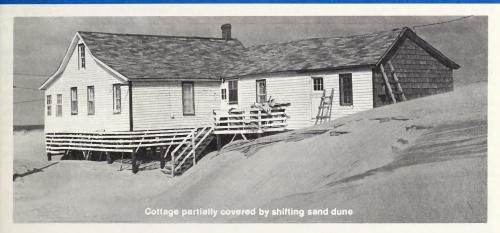


UNIVERSITY OF NORTH GAROLINA

SEA GRANT COLLEGE NEWSLETTER

MAY, 1977

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Planning for coastal development

In the spring of 1974, the North Carolina General Assembly passed a bill which was designed to protect natural resources and regulate development in the state's coastal area. It was called the Coastal Area Management Act (CAMA).

This controversial legislation made North Carolina one of the first states in the nation to pass comprehensive land use planning laws for its coastal area. The bill was in part a response to the Federal Coastal Zone Management Act passed by Congress in 1972. That act provided federal assistance to states to develop management programs for preserving coastal resources.

CAMA is based upon the assumption that the coast—with its estuaries, marshlands and ocean—is a fragile and ecologically important area. Because of its high recreational and economic value, there is growing competition for the use of the land and water. CAMA is an attempt to provide for orderly development of the coast, according to one

of the authors of the act, Thomas Schoenbaum of the UNC Law School.

"Much of what we have in the coastal area results from the fact that we have a relatively natural system," notes Gene Huntsman of the National Marine Fisheries Service. "We have good production of finfish and shellfish. In order to retain this we must make choices about what kind of development we will have. If we have unplanned development, we will lose the waters as a source of fish, recreation and occupations." Huntsman is also a member of the Coastal Resources Commission.

The act covers 20 coastal counties, all of which are bounded either by the Atlantic Ocean or a coastal sound. Basically, it requires each county to draw up comprehensive land use plans and provides for the designation of special areas of environmental concern (AECs).

The legislature established the 15-member Coastal Resources Commission (CRC) to ad(See "CAMA," p. 2)

CAMA gets underway in 20 coas

(Continued from p. 1)

minister the act. The commission was required to be made up of least one representative from each of the following interests: commercial fishing, wild-life or sports fishing, coastal agriculture, coastal forestry, coastal land development, conservation, local government, engineering, marine-related business and coastal development financing. Also required were two local government respresentatives and three at-large members. In addition the act set up a 47-member advisory council, which is made up largely of representatives from various state agencies and residents of the 20 coastal counties.

Primary among the CRC duties has been the task of selecting AECs and setting up standards for their use. The act states that permits for major development within the AECs must be obtained from the CRC. Major development is generally defined as that which occupies more than 20 acres or a structure of more than 60,000 square feet. Development which requires license or approval of some state agency is also under CRC jurisdiction. Permits for other development may be obtained from local governments in compliance with standards set up by the CRC.

The act provides virtually complete exemption from the permit requirement for utilities, agriculture and forestry, except where such development involves the dredging or filling of estuarine or navigable waters, according to Mike Black, CRC staff member. Judicial review is provided by the superior court of the county where the concerned land is located.

In the three years since CAMA went into effect, much of the act has been implemented. Land use plans have been drawn up by local governments in all 20 counties and 32 municipalities. Most of them have been officially approved by the CRC. Under the act, the CRC has no authority to enforce the plans and implementation is left to county and local governments. This spring and summer, synopses of county plans are being distributed to citizens in each county.

Public hearings were held in each county during April and May to get public sentiment on the proposed AECs. This was the third series of public hearings on AECs since CAMA was implemented. Following a public hearing in New Bern last summer, the CRC designated interim AECs. Since that time developers have been required to notify the CRC of proposed development in the AECs, but the CRC does not yet have permit-letting authority. If all goes on schedule, the final AECs will be designated by the CRC in June. That will mean that regulations on permits in these areas will go into effect by March 1978, according to Black.



Marshland on Portsmouth Island

counties

While CAMA has been hailed as model environgental legislation, opposition to the act remains real. A bill to repeal CAMA was introduced in the N.C. General Assembly this spring by Sen. jvingston Stallings of New Bern and Rep. Howard canin of Washington, N.C.

In some coastal counties opposition to CAMA is been loud. To date four law suits have been did against the CRC. Three of the suits are being rought by citizens' groups in Hyde, Carteret and slow Counties. A fourth suit has been filed by a Carteret County Commissioners. None of the aits have yet come to trial, but preliminary hearings on the Onslow and Carteret citizens' suits are meeted late this summer. Members of two groups, oth called Citizens to Save Our Land, are behind he suits, according to Wendell Ott. Ott is an atmery with the Greensboro firm Turner, Enoch, faster and Burnley, which is handling the cases.

The two organizations are loosely-knit and separate, but they share major objections to CAMA. The suits claim that CAMA is unconstitutional as its written and as it may be applied, said Ott. A major bone of contention for some of the plaintiffs is the issue of local versus state and federal control over land use.

"My clients see the creation of a new government bureaucracy to handle what has been a local ffair." said Ott.

Other opponents of CAMA have charged that, as local act, CAMA discriminates against coastal North Carolina and is therefore unconstitutional. Local acts are those passed by the legislature which to not apply to all areas of the state. According to schoenbaum, state law provides that the legislature an make local laws if there is "reasonable" justification for treating a certain section of the state differently. Opponents contend that CAMA does of provide that justification.

According to Ott, the suits also claim that ucessive legislative power has been delegated to non-legislative body, the CRC" and that the mocess for appealing a denial of permit to develop too lengthy and expensive.

Another argument commonly used against AMA concerns the legal issue of "taking" of reperty without due compensation.

The University of North Carolina Sea Grant College Newsletter is published monthly by the University of North Carolina Sea Grant College Program, 1235 Burlington Laboratories, Yarborogh Drive, North Carolina State University, Raleigh, N.C. 27607. Vol. 4, No. 5, May, 1977. Dr. B. J. Copeland, director, Written and edited by Karen Jurgensen and Mary Day Mordecai. Second-class postage paid at Raleigh, N.C. 27611.

What are the AECs?

The areas of environmental concern that have been proposed by the Coastal Resources Commission (CRC) fall into four major categories; the estuarine system, ocean hazard areas, public water supply and fragile natural resource areas.

The estuarine system covers an estimated 85 percent of the total AEC area and includes coastal wetlands, estuarine waters, public trust waters and the estuarine shoreline. The estuarine shoreline is defined as the area extending to 75 feet landward from the mean high water level or normal water level along estuaries, sounds, bays and brackish waters. These shorelines are considered to be especially vulnerable to erosion, flooding and other adverse effects of wind and water. Public trust areas include all navigable coastal waters, the part of the Atlantic Ocean that is covered by state jurisdiction (to three miles from shore) and the land under those waters.

Beaches, frontal dunes, excessive erosion areas and inlet lands make up the ocean hazard category. Inlet lands are erosion-prone areas located adjacent to inlets. The CRC has defined excessive erosion areas as extremely dynamic lands susceptible to becoming completely displaced by water due to periodic storm surges. The following areas (measured landward from the toe of the frontal dune) would be designated as part of the AEC in the eight ocean-fronting counties:

Dare, Currituck and Hyde Carteret 72 feet Onslow 133 feet Pender 112 feet New Hanover 156 feet Brunswick 144 feet

The public water supply category takes in small surface water, supply watersheds and public water supply well fields. Regulations would be aimed mainly at coordinating development which would affect a few coastal community water supplies, according to CRC staff member Mike Black.

A final category, the fragile natural resource area, is designed to include specific sites that would be nominated by the public. Nominations would be submitted next year to local governments, which would make comments and forward recommendations to the CRC. The CRC would make final designations. Complex natural areas, places that sustain remnant species and unique geologic formations fall into this category.

There are to date no regulations to control development in this type of AEC. Development in all other groups of AECs is already controlled by a number of state and federal regulations, including state dredge and fill statutes, state septic tank regulations and dune ordinances.

Two sides to the issue

Pro:

As chairman of the Coastal Resources Commission (CRC), David Stick is an official spokesman for the Coastal Area Management Act (CAMA). Born in New Jersey, he moved to the Outer Banks in 1929 and now lives in Kitty Hawk. An author and historian, he has written several books on North Carolina. Among his many former occupations, he lists real estate, contracting, map publishing and journalism. Following are excerpts from an April interview with Stick in which he explained his position on CAMA.

Do you think CAMA is necessary? Why or why

Definitely. The main reason for retaining CAMA is that for the last decade or so there has been continually increasing involvement of state and federal government in environmental and land use matters—especially in the regulatory phases—to the exclusion of local governments. CAMA offers the only opportunity I have seen for years for a reversal of this trend and for the active involvement of local governments in many matters which have become the exclusive domain of bureaucrats out of Raleigh and Washington.

The key to this is federal Office of Coastal Zone Management approval of a coastal zone management program for North Carolina. That means that when we get it [an approved plan] the federal agencies will have to consult the state and local plans. There is also a strong implication that some of the authority of federal agencies will actually be turned over to the local or state governments.

Another key reason is that though most of the (See "CAMA; Key." p. 5)





Con:

Sen. Livingston Stallings of New Bern is an outspoken opponent of the Coastal Area Management Act (CAMA). Now serving his third term as a state senator, he co-sponsored a bill to repeal CAMA during the current session of the General Assembly. He is a native of Craven County and a former county commissioner. Stallings has an insurance and real estate business in New Bern. Following are excerpts from an April interview in which he explained his position on CAMA.

Do you think CAMA is necessary? Why or Why not?

I think an act similar to CAMA that would be altered so that the act would apply to all of North Carolina would be very helpful to the state. Certainly we need to plan direction so that we can conserve our natural resources, so that the essential features of our coastline and our mountains and our piedmont that have a bearing on life in North Carolina should be looked upon and should be [treated] in a way that will preserve our natural resources.

What is your major criticism of CAMA?

My criticism is two- or three-fold. First [is] the fact that this act only applies to 20 counties in North Carolina. Nothing was done to work in the same direction in the other 80 counties. . . Even though some parts of it (CAMA) would not be applicable to the other counties, much of it would. And I say it's not constitutional applying to only 20 counties. That's one concern.

Secondly, this act does affect property rights. It does limit to a degree the use that one can make of his property and there is no provision made for remuneration in the event of a take-over of property rights or a curtailment of property rights. And

(See "It goes," p. 6)

CAMA: Key to "orderly growth"

(Continued from p. 4)

proposed AECs overlap existing regulatory programs, they [other programs] were adopted and were administered on a piecemeal basis. This [CAMA] is the first real effort to tie them together under one understandable umbrella.

Some people feel that the powers of the Coastal Resources Commission are too broad. What is your

response to that criticism?

It may well be that some of the powers of the CRC are too broad. We are working with members of the General Assembly on amendments to CAMA that would limit the authority of the CRC where it isn't essential to the CAMA program and where it seems to scare the daylights out of people on the basis of what we might do rather than what we have done or are doing.

Do you think CAMA is necessary from an eco-

logical standpoint?

From an ecological standpoint, it is not going to accomplish as much as the conservation enthusiast would hope. It is a method of getting local government and the state, with our commission serving as a bridge, working together on these problems. But as far as saving something that would otherwise be destroyed, there are few instances where CAMA will accomplish that.

Do you think CAMA should apply to the whole state?

To begin with, it can't-not as far as coastal resources are concerned—because coastal resources are unique to the coast. However, there are parts of CAMA that can apply statewide—specifically the planning. It would be fine, I'm all for it, I would like to see all counties and all cities that choose to develop their own plans for the first time.

Another criticism of CAMA relates to the question of local versus state control. Do you feel there

is a conflict here?

First, land use plans have been developed and will be implemented locally. There are no provisions for state control over the enforcement of land use plans. Second, the incentives are given to the local governments under the AEC program to handle all the permit-letting and enforcement in the minor developments which generally are those under 20 acres and buildings under 60,000 square feet and those not covered by another state regulatory program. This means that local governments will issue most all permits.

There are currently four law suits pending against the CRC. What does this kind of citizen

concern say to you about CAMA?

Somehow we have failed to get across to a large segment of the populace what this act is all about because most of the contentions that I've seen by the people who are filing suit are based on completely erroneous information. And I don't know that any of these that I have seen are wide-based citizens groups.

Some people believe that CAMA discriminates against the coastal area. What is your response?

My reaction to that is that if it is discrimination to have both the state and federal governments actively concerned with your local problems, to the extent that they are willing to put up vast amounts of money, so that you can address those problems yourself locally and come up with your own plans on what to do about them; then boy, give me more discrimination.

What effect do you think CAMA will have on

coastal development?

It is a key mechanism in providing for orderly, planned growth rather than the completely uncontrolled growth we have had in the past. It will make it easier for developers because they will know what they can and can't do. And it will mean that everyone will be in a position to understand the costs of growth before it happens instead of learning about the public and private costs when they get the bill after it happens.

What kind of opposition do you expect to hear

at the upcoming AEC hearings?

I'm sure that we're going to get a continuation of the same things that I have heard hundreds of times from the public, from local officials, from the members of the General Assembly who somehow feel that if an area is designated an AEC it means there can be no use of it and that they will be deprived of the right to use it, which is not true. The AEC program will simply make sure that whatever use is proposed is compatible with the capacity of the land and water resources to sustain that activity.

Some people contend that the proposed AEC regulations under CAMA involve the legal issue of "taking" of property. What is your response to that?

First, "taking" generally refers to the complete loss of use of property by the owner. Almost all of the AECs that we are now proposing are already covered by some other regulatory program. And if they aren't "taking" under the other programs, they sure aren't under ours. . . . We are proposing standards in uses of marshes, for example, that are now prohibited under dredge and fill regulations.

Now the structures on the foredunes, which is where the buildings fall overboard when you get a storm . . . this one might have to go to court to determine if it's "taking." We do feel and the AEC standards will so state that where you are in an excessively erosive area that all of the best data indicates will be gone in the next heavy storm, there shouldn't be any permanent construction. However, our proposals would allow structures on dunes if no other practical use can be made of an ocean front lot. And routes of appeal are built into the AEC proposals to make sure careful consideration will be given to permit requests.

"It goes further than is necessary"

(Continued from p. 4)

that is something that is very definitely opposed to by people in other parts of the state.

Do you think that CAMA adequately protects the public rights and environment of the coast?

I think that it goes further than is necessary to protect the essential coastal features that are vital to the continuation of marine life, to human existence and to the ecological considerations of our people. Instead of being what it started out to bea bill that protects those vital areas such as sand dunes, marshlands, shorelines-it ended up being a bill that goes much further. It [provides for] much further inland control. And, too, it lacks a feature I think it should have. That is a definite proviso that in every instance whatever is necessary in the way of permits to do certain things so as to carry out the function of the bill, these permits should be handled by the individual counties rather than by a commission or board or state agency that's housed someplace other than in each individual county.

... I'm contending that the people in a given area-the people of Carteret County, for instancewant to deal with the Carteret County Board of Commissioners. They should be able to go to those commissioners, who have with some guidance established rules and regulations and [can] issue permits right out of their county courthouse.

Is there any particular group that you feel will

be most affected by CAMA?

I think those who are living on the streams, the rivers, the sounds and the ocean, those who have land bordering these areas are the most directly

There are currently four lawsuits pending against the CRC. What does this kind of citizens' concern say to you about CAMA?

It says to me that there is considerable concern

on their part that they are losing property rights. which makes the law unconstitutional.

You mentioned "unnecessary aspects of the bill."

What do you think they are?

The bill needs to be simplified and it can be simplified. If we are going to continue with a statute such as this on the books, it ought to be modified so as to make provisions that are going to be maintained. We should make those provisions applicable to the entire state, not saddle all the burden on 20 counties and let all the rest of the state, so to speak, go free. At the same time the controls ought to be brought back to local government as the number one source. Certainly if local government abdicates its responsibilities in handling whatever controls are let, then it should be provided. . . that some higher authority should enforce those provisions.

Would you like to see CAMA repealed?

Only if that's the only way-if we cannot get the other counties to agree so that we can get sufficient votes from the legislature to make this a statewide item. It ought to be a statewide item,

How do you think CAMA will affect develop-

ment on the coast?

I think it's going to make it very difficult for developers to move ahead. It puts a considerable amount of red tape in their way.

What response have you received from your

constituents on CAMA?

I have had nothing but a continuous communication: "Please do something about CAMA." And they continue to say that they want relief either in the way of a repeal or they want it altered to the point that they can live with it.... These are people from all walks of life who live in these coastal areas. They all have one common denominator. They're all landowners.

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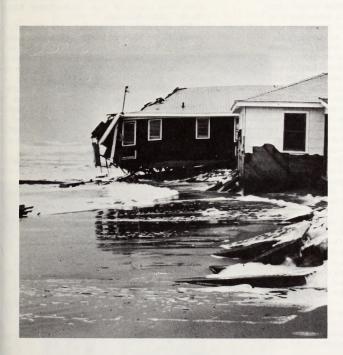


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June, 1977

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It's hurricane season again



In October of 1954 Hurricane Hazel swept in at North Carolina's southern border and barrelled northwest through the state. She brought wind speed of 130 miles per hour and tides that had devastating effects in Brunswick, New Hanover, Pender and Carteret Counties. She left a wide path of destruction behind her.

The following year Hurricanes Connie, Diane and Ione hit North Carolina within a period of six weeks. In 1960 Hurricane Donna hit land at the Cape Fear River and moved straight up the coast before it exited at the Virginia border.

By many accounts, Donna was the last severe hurricane to hit the North Carolina coast. The rest have been just "close calls." But, according to the National Weather Service, that pattern of good luck may be changing. From about 1940 to the early 1960s, most Atlantic hurricanes turned east of Florida and affected the Atlantic coast. Since then, however, hurricanes have tended to make a northward curve in the Gulf of Mexico and strike the Gulf states. The weather service contends that the pattern is shifting again, bringing more hurricanes to the North Carolina coast.

(See "Hurricane," p. 2)

Hurricane: "It hits like a batte

(Continued from p. 1)

Hurricane Donna was 17 years ago, long enough for many people on the coast to forget how dangerous a powerful storm can be. But the planners in the Division of Civil Preparedness (Department of Crime Control and Safety) in Raleigh haven't forgotten. As this year's hurricane season got underway in June, they were busy putting the finishing touches on detailed plans for emergency hurricane evacuation of all North Carolina's coastal counties. The plans are being drawn up by local governments based on a prototype developed by the division. Called Carolina County, it is being used by coastal counties from Maine to Texas.

Basically, the model plan calls for moving people off the beach strands to higher elevations and into the best available shelters. The division bases its calculations on a maximum storm surge of 18 feet anywhere off the state's coast. That means that residents should be evacuated to an elevation of at least 25 feet. Public shelters must be sturdy and have some means of food preparation, sanitary facilities, food stocks and stand-by power. Though local governments are responsible for them, they are often operated by the American Red Cross.

The beach areas of the coast pose some knotty problems for the evacuation planners. On the fragile strip of islands that make up the Outer Banks, the main problem is limited access. One two-lane road runs from Duck to Hatteras. Two bridges connect Bodie and Hatteras Islands to Roanoke Island and the mainland in Dare County. At some spots, the road washes out easily. The only other access to the mainland is by ferry. Summer-time tourist crowds compound the difficulties.

"On the Outer Banks, you've got a lot of people and limited access roads. If they get caught out there, there's going to be trouble," said Bill Harris, a civil preparedness planner.

The National Park Service has also stated that severe storms might easily open up inlets at three locations on the Outer Banks—on Ocracoke Island, just north of Buxton and just north of Rodanthe.

The Bogue Banks and Brunswick County areas pose the additional problems of being heavily populated during the summer season. A two-lane bridge at each end of Bogue Banks connects it to the mainland of Carteret County.

"On a Saturday night in season, if one exit should be cut off, it would take in excess of ten hours to evacuate all vehicles from the island," said Dan Spurling, operations officer with civil preparedness.

Spurling pointed out that during the warning for Hurricane Belle last year, many people evacuated. Both exits were free and still the traffic was bumper to bumper, he said.

In Brunswick County access roads connect the beach areas to the mainland and there is high ground three to four miles off the beach. The prelem, noted Harris, is to get people away from the beach strand before the tide rises. Many of the access roads have float and draw bridges to can easily wash over when the tide rises. Officinestimate it would take about four hours to club beach strand in Brunswick County.

If there is enough time, civil preparedness p sonnel prefer that residents and tourists evacu in their own vehicles. The next option is the use high clearance vehicles, such as trucks, to me people out.

One of the problems evacuating crews face that residents and vacationers are often reluct to leave beach areas. "Their experience sa 'We've lived through everything so far. We'll I through the rest.' But the potential for a storm completely wipe off that bank (Outer Banks) there," said Spurling.

Spurling believes that there are generally th groups of people who want to be in a coastal al during a hurricane: residents reluctant to let their homes, surfers and thrill seekers. The sur up during a storm and some adventurous surfalways want to take to the ocean, he noted.

The thrill seekers, said Harris, are people w don't understand the power of a hurricane. Wh Hurricane Camille hit Louisiana in August 1969, 22 people from one household died. Th refused to evacuate and stayed at the coast for "hurricane party." The sole survivor was a ch who floated out on a mattress, Harris said.

A hurricane is a tropical storm with winds the reach a minimum of 74 miles per hour. In stori



Extensive damage to Wilmington hotel after Hurrill

g ram

in the Northern Hemisphere, the winds blow in a counterclockwise direction around the calm center of the storm, called the eye. The most ferocious winds are about 20 miles to the right of the eye. There is an average of six hurricanes per year on the Atlantic coast. They are born in the tropical and subtropical North Atlantic Ocean, the Caribbean Sea and the Gulf of Mexico. The storms begin to die once they hit land.

Though the winds can reach ferocious speeds, the water surge is always more dangerous. The hurricane brings with it huge waves, which raise tides 15 feet or more above normal. If the rise comes quickly, it can produce flash floods in nearby estuarine areas. It may bring giant waves, erroneously called "tidal waves."

"That storm surge is a big solid mass of water. It hits like a battering ram. Nothing could stop it," said Harris. Debris which is transported by either air or wind or water is an added hazard.

The Division of Civil Preparedness is responsible for providing emergency services and damage assessment for areas that have been hit by hurricanes. This year UNC Sea Grant is sponsoring an experiment that might make their work more efficient. Simon Baker of Sea Grant advisory services will be helping to test the effectiveness of obliqueangle aerial photography for immediate damage assessment. Baker is currently working with the Raleigh squadron of the Civil Air Patrol to take an initial series of photographs which will be used for comparison with post-hurricane photographs. A squadron plane with photographers will fly over affected areas as soon as possible after a storm.



Here's what to do

The hurricane season has already begun in North Carolina. The National Oceanic and Atmospheric Administration (NOAA) urges you to prepare for a possible hurricane now. Be sure you have an adequate supply of boards, tools, batteries, non-perishable foods and other items you would need.

Remember that a hurricane watch means that a hurricane may threaten your area within 24 hours. A hurricane warning means that a hurricane is expected to strike within 24 hours.

Here are some additional tips from NOAA:

When you hear the first storm advisory, listen for further messages. If there is a hurricane warning, continue your normal activities, but stay tuned to your radio or television.

If you hear a hurricane warning:

Stay calm.

Leave low-lying areas.

Leave $mobile\ homes$ for more substantial shelter.

Moor your boat securely before the storm arrives or move it to a safe area. If your boat is moored, don't return to it once the wind and waves are up.

Board up windows or protect them with storm shutters or tape.

Secure outdoor objects.

Store drinking water in clean bathtubs, jugs, bottles and cooking utensils. Your water supply may become contaminated.

Check your battery-powered equipment. If utility service is interrupted, you will need a radio, emergency cooking facilities, lights and flashlights.

Keep your car fueled.

Stay at your home if it is sturdy and on high ground. Otherwise, move to a designated shelter.

Evacuate if you are told to do so.

Don't go outside until you are advised that the storm is over.

Studying the stability of beaches

Building a home close to the beach can be a risky business. Deeds to coastal property don't come with guarantees of safety from Atlantic Ocean storm surges. But two Sea Grant-supported scentists are now doing research that might take some of the guess work out of selecting a relatively stable building site.

Paul Hosier and Bill Cleary of UNC-Wilmington are studying the history of overwash from storms on the coast. Using aerial photography and on-site surveys, they are looking at the patterns of overwash between Cape Lookout and Cape Fear from 1938 to the present. So far their study indicates that some areas are much more stable than others. They hope to produce maps and guidelines that prospective homeowners can use to determine the relative stability of beach property.

Overwash occurs when high waters breach the sand dunes and invade coastal land. The wall of water may destroy man-made construction. It also leaves its mark on the natural environment of the beach. It frequently uproots vegetation and flat-

tens sand dunes, carrying sand to the inland side of a barrier island or dragging it out to sea again. The displaced sand is usually deposited in a fan shape behind the original dune line. A severe storm or a series of storms may result in deposits that form terraces.

In almost all cases, natural forces will rebuild the dunes and revegetate the area. In the meantime, though, the overwashed beach is more vulnerable than ever to storm damage. Hosier contends that revegetation of an overwashed beach occurs in predictable stages. Identifying the condition of the dunes and the type of vegetation growing in an area can give one a good idea of when the last overwash occurred there.

According to Hosier, hurricanes are responsible for the greatest amount of overwash on the North Carolina coast. Other storms, such as the winter northeasters that plague the coast, may cause overwash and are frequently responsible for more erosion than hurricanes.

(See "Storms," p. 6)

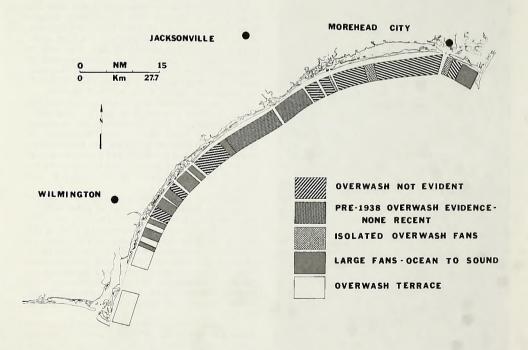


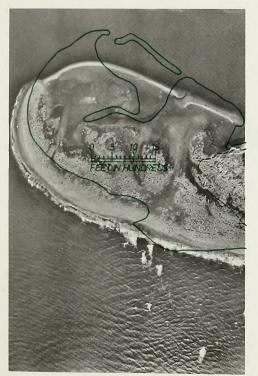
Chart illustrates overwash intensity between Cape Lookout and Cape Fear,

Our shifting tidal inlets

North Carolina's tidal inlets are fickle products of an ever-changing coastline. They open, close, widen, narrow and migrate—sometimes with no warning at all. The impetus for change is often a hurricane or similar storm.

Coastal North Carolina now has 22 open inlets. But there have been many others in the past. Three inlets, Cape Hatteras, Oregon and Ocracoke Inlets, are now open on the Cape Hatteras National Seashore. According to the National Park Service, eight other inlets have opened and closed along the seashore (some of them several times) since the earliest records in 1585. Tubbs Inlet in Brunswick County migrated a total of 3400 feet between 1938 and 1969. In fact, of the inlets now open, only Cape Fear and Barden Inlets and the west side of Beaufort Inlet appear to be relatively stable

In spite of their fluid natures, tidal inlets play crucial roles in the coastal environment. They connect rivers and estuaries with the ocean and so con-



Aerial photograph shows migration of inlet.

trol the circulation of water and sediment in the whole estuarine system. They affect pollution control, navigation, recreation, flood discharge and fish migration.

Inlet changes sometimes affect man very dramatically. If a storm opens a new inlet, it may flood private property and destroy communities. But in recent years man has had a growing effect on inlets. Two of North Carolina's inlets—Drum Inlet and Carolina Beach Inlet—are man-made.

As is often the case when man tinkers with natural forces, unexpected things happen. The case of Drum Inlet is an example of the kinds of difficulties that can ensue. In 1971 the U.S. Army Corps of Engineers blasted open Drum Inlet in Core Banks, just off the coast of Carteret County. The inlet was opened to increase the salinity of Core Sound and to give fishermen a passageway to the ocean. Old Drum Inlet, which was located two miles north, had previously filled with sand.

The new inlet was expected to widen to about 1500 to 2000 feet. Erosion continued at an unexpected rate, though, until the inlet was 3350 feet wide. Residents of the area complained that the widened inlet exposed them to increased danger from storm waves. In 1974 the Corps of Engineers stopped maintenance dredging and the inlet opening has narrowed to about 2000 feet. The corps is now considering several alternatives designed to break the force of storm waves and to decrease erosion south of the inlet. One plan calls for building man-made islands at the mouth of the inlet.

This year UNC Sea Grant is sponsoring research which is aimed at predicting the effects of manmade changes on flow dynamics and sediment movement in tidal inlets. Jerry Machemehl of NCSU has already developed a finite element flow model for a typical barrier island inlet. The model can be used by coastal engineers to assess the effects of inlet alterations on the shoreline and estuaries.

Machemehl is also studying the flow dynamics of Carolina Beach Inlet, located 18 miles north of the Cape Fear River in New Hanover County. The Corps of Engineers is now considering altering the inlet to improve navigation and to halt excessive erosion on the beach south of the inlet. One alternative is to construct jetties with an excavated channel or to excavate an entrance channel and use frequent maintenance dredging. Machemehl will be using the model he has developed to predict the effects of proposed navigation improvements at the inlet.

UNC Sea Grant has recently published a booklet which tells the stories of North Carolina's existing inlets through photographs. The Citizen's Guide to North Carolina's Shifting Inlets, was written by Simon Baker of Sea Grant advisory services.

Storms affect formation of dunes

(Continued from p. 4)

So far Hosier and Cleary have seen some definite patterns emerge. The most chronic overwash appears to have occurred between Ocracoke and Cape Lookout, and the area from Figure Eight Island to Carolina Beach runs a close second. Hosier notes that the land just north of all the capes seems to be particularly vulnerable to overwash. He believes that Bogue Banks, Bear Island and Browns Island have never been overwashed.

Areas of chronic overwash have a number of characteristics in common, said Hosier. These beaches generally have scattered individual stands of salt meadow cord grass and individual clumps of sea oats. They also may support ten to 15 species of annual or perennial plants, such as goldenrod or dune spurge. There is little or no dune formation.

If a barrier island has been overwashed about every ten years, there will be a weakly developed dune ridge, Hosier said. A single strand of shrub thicket and a salt marsh will be behind the dunes.

Areas that are seldom or never overwashed have the classic barrier island features. Dunes form in ridges or fields and slope gently to the beach. There is a strand line, indicating that the beach is not eroding. And there are shrub thickets and a salt marsh behind the dunes.

Hosier and Cleary are also finding that the type of sand available in an area has a significant effect on the stability of dunes. Because it can be easily blown by the wind, fine-grained sand forms into dunes more quickly than coarse-grained sand.

Coarse sand tends to form smaller, broken lines of dunes, called haystack dunes. Fine sand forms ridges or fields of dunes which act as a better barrier.

Two of the islands near Wilmington which were overwashed during the Ash Wednesday storm of 1972 clearly illustrate that point. On Masonboro Island there is coarse sand and poor dune formation, but on nearby Coke Island fine-grained sand has formed stable dunes.

Preliminary studies indicate that the difference in sand may be responsible for the fact that beaches along the southern portion of the coast are smaller and less stable than those in the north. Cleary conjectures that Hurricane Hazel of 1954 may have caused a deficit of fine sand on southern beaches. He believes that the storm may have taken much of this dune building sand five to ten miles out in the ocean.

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SEA GRANT COLLEGE NEWSLETTER

July, 1977

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Coastal lessons for summer

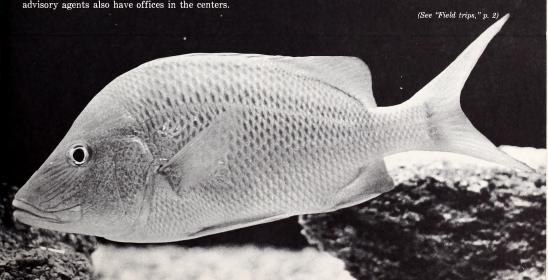
Going to the beach this summer? Take an education break while you're there. Visit with a sea turtle. Contemplate a moray eel. Find out what makes a marsh work and how sand dunes form.

You can do it all at the North Carolina Marine Resources Centers, located near Fort Fisher, on Bogue Banks and Roanoke Island. Operated by the state Office of Marine Affairs, the three centers were built with \$4.6 million in state and federal funds. They opened to the public last September and their first summer's schedules are packed with activities for folks of all ages.

Interested in marine animals? Highlights in each center are 300 to 500 gallon aquarium tanks. They house about 100 species of fish and crustacea which are native to the North Carolina coastal fresh, estuarine and ocean waters. Among the favorite attractions are octopi, lobsters and sea turtles. And there are mini-tanks for smaller creatures—such as sea horses, grass shrimp and sea urchins.

Located in natural settings, the centers offer excellent opportunity for studying the local ecology. Inside, visitors can browse through varied exhibits. Guided tours are available for school groups and other organizations. Teachers can arrange for films and hands-on exercises for their groups.

The centers were designed as learning labs for tourists, school groups and research scientists. They are equipped with research labs which have been used by scientists from Sea Grant and other programs. Sea Grant



Field trips anyone?

(Continued from p. 1)

Exhibits, films, lectures and field trips at each center are open to the general public at no charge. Here's a brief run-down of some activities planned for this summer:

Roanoke Island

The center will offer a field trip and a workshop each week. Scheduled workshops include mounting fish; fish filleting, handling and storing; coastal awareness through photography; and driftwood crafts. Field trips will include a coastal bird walk, sound shore investigation, a strands walk and a visit to a maritime forest.

Weekly seminars on a variety of marine subjects will continue. And the center will offer educational films several times daily. For further information, call 473-3493.

Bogue Banks

The Bogue Banks center is offering three special moonlight field trips to observe the egg laying and hatching behaviors of the loggerhead sea turtles. Also on schedule are four one-day snorkeling trips to Radio Island and two night snorkeling trips.

Weekly field trips include visits to a salt marsh and to the ocean and Bogue Sound for seining. On one trip participants will study naturally occurring plants on the barrier island. Center staff will also lead biweekly trips to nearby rock jetties, where groups can observe life in the inter-tidal areas.

Participation on some field trips is limited. Preregister in person or by calling the center, 726-0121.

General interest films on marine life are shown daily and a film series on Thursday nights features sea adventures and sea science.

Fort Fisher

Summer field trips at the center in Fort Fisher are scheduled from June 20 to August 8. Participants will need their own transportation and children under 12 must be accompanied by an adult.

On a beach field trip, guides will point out changes in southern New Hanover County over the past 100 years. A trip is planned to Carolina Beach State Park to study a pocosin, a type of swamp common to coastal North Carolina. Established in low boggy areas, this unique plant community includes venus fly traps, pitcher plants and sun dews. That trip will include an optional two-mile walk to Sugar Loaf, a very old sand dune. There will be other trips to nearby tidal pools and salt marshes.

The center will continue to offer weekly seminars on marine subjects. Educational films, suitable for adults and children, will be shown every Wednesday

Pre-register for trips by calling 458-8257.



School children at the Bogue Banks Center

Mariners Museum

If you're in Beaufort, don't forget the Hampton Mariners Museum. It's nestled on Tucker Street in this quiet historic town, just a block from the waterfront.

The coastal branch of the Museum of Natural History in Raleigh, the Mariners Museum grew out of the old Hampton Marine Museum. It now offers exhibits, field trips and lectures in natural and maritime history.

Though it's unimposing from the exterior, the little museum is packed with treasures. There are aquaria containing salt water fish native to North Carolina, a large collection of sea shells and a small collection of stuffed shore birds and waterfowl.

The maritime section of the museum contains a large collection of ship models, dating to the early days of shipping. There are also exhibits of charts, navigation instruments, maritime artifacts and plans for common North Carolina boats.

Staff biologists conduct numerous field trips during the summer, including salt marsh and shell collecting walks, tidal flat trips and bird walks. A trip to visit boat builders in the Beaufort area is planned. Make reservations in advance by calling 729-7317.

The museum is open six full days a week and on Sunday afternoons.

Marine studies

Summer school for teachers

The North Carolina Marine Resources Center at Bogue Banks is bustling with more than the usual activity. This summer the center is the classroom for 34 North Carolina public school teachers. Their subject: marine studies.

The teachers are participating in two Sea Grant projects designed to enrich marine education in the public schools. The programs are being carried out in cooperation with the North Carolina Department of Public Instruction and the North Carolina Marine Resource Centers. Public education is one of the main functions of the three centers.

"Sea Grant's interest in marine education is based on the assumption that an educated public will be more responsible in its decision-making about the coast and ocean," explained Dr. William Rickards,

associate director of UNC Sea Grant.

Looking at the environment

Rickards is coordinator of the Marine Awareness Program, which got underway at the Bogue Banks center in June. Six teachers spent a week at the center for an intensive introduction to marine science and the facilities of the centers. They studied a variety of marine environments, including the dunes, beach fronts, ocean, marshes and maritime forests. Then the teachers packed up and went home to work individually on developing lesson plans for teaching marine subjects in grades 6 through 9.

The lesson plans will be designed to complement physical, natural and earth science curricula already used in those grades. Each teacher will produce a lesson plan for about five hours of classroom instruction in a marine subject area. The plans will be written so that they can be used in any middle school classroom. But they can be most effectively used in conjunction with a field trip to any one of the three marine resources centers, Rickards pointed out. During the school year the centers host hundreds of school groups from all over the state.

The product of the teachers' research will be printed packets of materials which will be availble to teachers through Sea Grant and the North Carolina Department of Public Instruction.

Jake Brown, a science consultant with the department of public instruction, believes that the new materials will be more appealing to the North Carolina student than most textbooks. "Often the books are so dry in their presentation that they can't present the little exciting side views. We can do that. Also all textbooks are national... I think sometimes that special materials are needed for North Carolina," he said. Brown is on the steering committee for the marine awareness program.

A month-long teacher education program entitled "Man and the Seacoast" got underway at the Bogue Banks resources center July 18. Twenty-eight

teachers from Currituck to Asheville are participating in the multi-disciplinary course. They will study everything from Thoreau's Cape Cod to the geology of the North Carolina coastline. Environmental science, geology, oceanography, chemistry, coastal zone planning, anthropology, sociology, economy and literature are all on the course curriculum.

"The problems that face the seacoast and its development are not single-faceted problems. They are multi-faceted. You have to understand the economics as well as the technology," explained Dr. Dirk Frankenberg, director of the Marine Sciences Program at UNC-CH. Frankenberg and Dr. William Still, history professor at East Carolina University,

are co-coordinators of the project.

The teachers will hear eight guest lecturers from various departments in the University of North Carolina system. Each faculty member will present a general interest public lecture on marine aspects of his field, followed by two days of formal instruction. Sunday and Wednesday night introductory lectures at the center will be open to the public until the course ends August 13.

Teachers were selected on the basis of their teaching skills and their interest in incorporating marine science into the curricula of grades four through eight. "Man and the Seacoast" is aimed at the middle grades because they can best accommodate the inter-disciplinary approach. It is expected that the course will be greeted with enthusiasm because teachers at these grades generally have fewer enrichment opportunities than teachers of elementary or high school.

Making lesson plans

Working in groups, participants in the course will help to convert the lectures into materials that can be used to introduce other North Carolina teachers to marine studies. The new materials will include suggested lesson plans and project designs. The teachers will be expected to share that information with other middle school teachers in their school systems during teacher work days next fall. They will also receive three units of credit toward the required renewal of their teaching certificates.

Course activities will not be confined to the classrooms of the resources center. "The idea is to provide them (the teachers) with an experience as well as some information. We're going to talk about these things and let them see them too," said

Frankenberg.

Field trips will be an essential part of the course. Among those planned are a trip to nearby areas to study native plants and animals, a visit to the fishing and boat building community of Harkers Island and a trip to an excavated site of an ancient Indian fishing camp.

Sorting out the legal issues

As life in the coastal areas becomes more complex, so do the legal issues surrounding it. In the United States, a huge body of law has grown up around the ocean and the coast—a body of law that becomes increasingly important as the struggle for the control of limited resources intensifies.

Dr. Thomas Schoenbaum, a faculty member of the UNC School of Law, is trying to help others interpret and understand this complex body of law. This summer, with Sea Grant support, he is teaching the state's first ocean and coastal law policy course.

The course is being offered in a five-week summer school session for law students and graduate students in marine sciences at the UNC School of Law. Course work is based on a two-volume text prepared by Schoenbaum and seven of his students and published by UNC Sea Grant.

Schoenbaum believes that the texts will be helpful to scientists, policy makers and lawyers in other states.

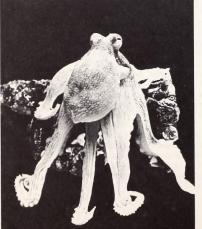
The course will cover ocean and coastal law of the United States. Schoenbaum believes that it will be useful to lawyers going into private practice in the coastal area as well as to the growing numbers of law graduates who enter government work.

"We have a lot of coastal education programs, but there's no course in any of the universities in this state on marine policies or law. Everybody who works with the coastal area will have some contact with marine policy or law," he said. Course work covers seven major areas. Ocean law topics include the international law of the sea, fisheries management and marine mammal protection, and laws concerning marine pollution control. Schoenbaum will also discuss laws governing nonliving resources, especially those which control mining on the Outer Continental Shelf and the building of floating nuclear power plants.

Under coastal law, students will study the public and private rights to coastal resources, construction and regulatory activities of the U.S. Army Corps of Engineers and land use planning.

As part of the two-year Sea Grant pilot project, graduate students are doing legal research designed to benefit the state. They are trying to determine how the state can manage its Outer Continental Shelf resources. They're looking at the state's role under the new federal extended jurisdiction law. And they are attempting to develop a better maintenance, control and scheduling system for the state's 11 major research vessels.

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SEA GRANT COLLEGE NEWSLETTER

August, 1977

1235 Burlington Laboratories NCSU. Raleigh. N.C. 27607 Tel: (919) 737-2454

It's falling into the ocean



In 1864 Fort Fisher stood staunchly on the lip of the Atlantic Ocean, manned by Confederates protecting the vital port of Wilmington. Its huge earthen mounds stretched a mile and a half along North Carolina's coast.

Today only a handful of earthen mounds remain of what was once considered the strongest fortification in the world. But it wasn't the Civil War that destroyed it. Since 1865, the main challenge to the fort has been the ever-creeping erosion of wind and waves. It's a battle which, without a lot of intervention, the fort is destined to lose.

Like much other construction on the coastline, Fort Fisher is slipping into the ocean. Unfortunately, it seems to be eroding faster than any other area of the state. Erosion of the fort has been a consistent phenomenon since 1865 and has averaged 15 feet per year. It has eaten away at the beach, the remains of the fort, vegetation and a state owned picnic area. U.S. Highway 421, which runs from Wilmington to the tip of the barrier island has been washed out and relocated twice.

The problem also plagues other historic sites along the coast. At Cape Hatteras, for example, the ocean has been encroaching dangerously on the famous lighthouse for years—in spite of efforts at erosion control. Clay Gifford of the National Park Service has watched the sea carry off protective sandbags "as big as automobiles."

Much of the erosion at Fort Fisher can be attributed to hurricanes and northeasters. Four severe hurricanes in 1954 and 1955 snatched large portions of the fort and inspired the state to begin its first tentative efforts to control erosion there. Rubble, including broken concrete and brickwork, was piled on the bluffs. In the early 1960s sand was piped onto the beaches, but it was rapidly washed away.

(See "expensive engineering," page 2)

Expensive engineering may save slipping fort

(Continued from page 1)

Until then man had only added to the erosion problems at the historic site. Some contend that the taking of coquina rock from the beach for road construction in 1926 compounded the difficulties.

The rubble revetment is now in poor condition. Many people are no longer content to sit silently by while erosion continues its inevitable work. The U.S. Army Corps of Engineers intends to do something about that. Its recommended plan for erosion control of the area has been authorized by Congress. The plan includes building a stone revetment which would stretch along the entire bluff fronting the Fort Fisher historic site—a distance of about 2000 feet. Beach fill would be applied to 8000 feet of the shore, making the beach an average of 80 feet wide. Seven groins, varying from 260 to 430 feet in length, are called for.

Like most serious erosion control plans, this one carries a big price tag. The current estimate for the major construction is \$7.4 million. Federal funds will cover 70 percent of those expenses. The state will pick up the rest of the bill. And that won't be the end of the expenses. Study manager Lim Vallianos, with the Wilmington Office of the Corps of Engineers, estimates that the state's annual fees will average \$90,000 for beach replenishment and maintenance of construction.

At any rate, the state probably won't have to dip into its pocketbook any time soon. The Corps of Engineers has scheduled two-year design work on the project to begin in 1979. Construction will take

another two years.

Vallianos doesn't see the Fort Fisher plan as just another in a long series of futile efforts to stop nature's erosion. He contends that the project will offer a permanent solution. "It will maintain itself as long as the program of nourishment of the compartments between groins is implemented," he said. Without the plan, Vallianos predicts that U.S. Highway 421 and the entire Fort Fisher site will be eroded away by about 1998.



Remains of a former U.S. Highway 421, washed out by erosion.

For visitors only

Nature's erosion and man's construction have not completely destroyed the ocean-side Fort Fisher. Seven mounds that were part of the original land face of the fort are still intact. The mounds are laced with trails and surrounded by a reconstructed palisades fence.

More than 400,000 people visit the nearby Ft. Fisher Visitor Center/Museum annually. Built in 1965, the center houses exhibits, including artifacts from the site and restored items from sunken blockade runners. The museum is open free to the public Tuesday through Saturday from 9 a.m. to 5 p.m. and Sunday from 1 p.m. to 5 p.m.

Fort Fisher is located 14 miles south of Wilmington on U.S. 421. It can also be reached by toll ferry from

Southport

Across the street from the center, there is a picnic area in the small maritime forest located just behind the beach. The beach, with its outcropping of coquina rocks, is also open to the public. During low tide, the rock outcropping is a favorite spot for sports fishermen. A monument to the Confederate dead overlooks the ocean from the adjoining Battle Acre. Part of the fort which once stood on that spot has been eroded.

The North Carolina Underwater Preservation Laboratory, also on the grounds, was built immediately after the wreck of the Modern Greece was salvaged in 1952. The ship sank a half-mile north of Fort Fisher in 1862. A group of Navy divers brought up about 11,000 artifacts. Many of them, in addition to artifacts from other North Carolina shipwrecks, are on display in the visitor center/museum. The preservation lab also offers a field school in the summer for college students. The curriculum includes the basic techniques of underwater archaeology. The lab is not open to the public, but special tours can be arranged for school groups.

The Fort Fisher area is famous for its shipwrecks, many of them casualties of Civil War confrontations. Diving on the wrecks is permitted, but anyone planning to remove materials from a wreck must have prior permission from the preservation lab.

The National Park Service has named the Fort Fisher area a national historic landmark, and further recreational development of the area is planned. The state of North Carolina has purchased nearby lands which are intended for public recreation. About two miles south of Fort Fisher is the Marine Resources Center/Fort Fisher, an educational facility which is also open to the public. A toll ferry just south of the center connects the barrier island to Southport.



Confederates manning a Fort Fisher battery during the Civil War. Photo courtesy N.C. Division Archives and History.

Confederate masterpiece with a rocky history

At the height of its glory, Fort Fisher was the mainstay in a system of forts devised to protect the invaluable lower Cape Fear River. It was the vital link which kept open the port of Wilmington until the very last months of the Civil War, allowing dare-devil blockade runners to slip in and out of New Inlet.

The blockade runners were loaded with provisions, clothing and war munitions for the troops and civilians of the Confederacy. Wilmington's foreign commerce boomed. Towards the end of the war, it was the Confederacy's only supply link with the outside world.

But even in its prime, Fort Fisher was an unfinished masterpiece. Its story began in 1861, when a two-gun earthenwork battery was constructed on the northern side of New Inlet at Federal Point (called Confederate Point during the war). The following year Major (later Colonel) William Lamb assumed command of the fort and began to mold it into his vision—a formidable earthenware fort modeled after the Malakoff of the Crimea.

Under Lamb's direction, slaves and military men were put to work building the huge traverses, bombproofs and gun batteries. Conditions were difficult. Exhausted soldiers wrote home complaining of rats in the cistern and "mosquitoes as large as hummingbirds."

At one time there were as many as 1000 men working on the fort, including 500 slaves. But construction progress was thwarted by the fact that troops stationed at the fort were constantly being called to

the defense of other vital points in the Confederacy. And, much to Lamb's dismay, he was unable to persuade North Carolina's Governor Vance to send more workers and slaves to finish the task.

The fort stretched in an L shape from the Cape Fear River to the ocean and down the length of the beach. The section guarding land was located a mile and a half north of New Inlet. About 900 yards in length, it consisted of 15 mounds and ended in a bastion at the point of the angle. The first 100 yards of the sea face were similar in construction. But the remainder (1400 yards) was a series of small mound batteries connected by infantry fences.

On the edge of New Inlet, Fort Buchanan stood isolated. Though it was a mile and a half from the end of the sea face, it was a vital part of Fort Fisher. This massive earthen mound held guns to cover the inlet and stood ready to receive beaten troops who might then retreat by water.

In late 1864 the Union realized that it would have to sever the Confederacy's supply link at Wilmington if it was to win the war. On Christmas Eve, 1864, Federal troops first attacked Fort Fisher. Seeing that they didn't have enough forces to take the fort, they retreated. But they returned by land and water to launch a much stronger attack on the afternoon of January 13, 1865. The fort was finally invaded the afternoon of January 15 and Confederate forces surrendered that night. They had suffered a loss of 500 men; the Federal casualties totaled 1500.

The Confederate plan to use Fort Buchanan as a retreat point also failed. Wounded commanding officers Whiting and Lamb were among those who arrived at Fort Buchanan to find that Confederate Navy forces had abandoned it and taken the boats. By February 21, 1865, Wilmington was occupied and the Confederacy's lifeline had been cut. The fall of the Confederacy followed swiftly.

But that was not the end of Fort Fisher's history as a military installation. During World War II it was used to protect the Federal Point-Smith Island area from submarine attack. The fort became part of the Camp Davis training center, located at Holly Ridge. Wells were sunk; barracks, machine gun nests and other buildings were constructed. Ammunition bunkers can still be seen along the road just north of Battery Buchanan. An experimental radar tower looms over the beach today.

Construction during World War II also meant the loss of part of the Civil War historic site. Confederate land face mounds were flattened to make an airstrip. And more than half of Battery Buchanan was dismantled to build bomb proofs to protect the ammunition bunkers.

Most of the World War II buildings were in turn destroyed when the Fort Fisher area became part of the buffer zone of Sunny Point Ammunition Loading Terminal during the early 1950s. It wasn't until 1965 that the state of North Carolina built a visitors center/museum on the site to preserve its Civil War history. The remaining batteries were restored and a palisades fence was reconstructed.

Researcher studies Fort Fisher geology

Tom Moorefield has become a familiar figurearound Fort Fisher this summer. Nearly every morning, he rolls into the visitor center parking lot in a 15year-old van, affectionately dubbed the "Gray Ghost." Attired in his usual garb of tennis shoes, shorts and a t-shirt, he heads for the beach.

But unlike most visitors to Fort Fisher, Moorefield is not off for a day of seaside rambling. He's there to observe the natural geologic processes in the life of the beach and to collect sediment sam-

"I may see that part of this rock is uncovered or that sand has moved in a new direction on a certain section of the beach," he said.

A graduate student in geology at East Carolina University, Moorefield has Sea Grant mini-grant funding to study the geology of Fort Fisher and the surrounding estuaries and marshes. He hopes to come up with an explanation that might shed some light on the severe erosion problems of this historic site. When the research is completed next fall, he plans to draw up environmental and geologic maps of the area.

Moorefield is no stranger to the Fort Fisher area or to the problems of beach erosion. As a child he spent summers at his family's cottage on nearby Carolina Beach. He remembers well when Fort Fisher beach offered a much wider expanse of sand. In those days, he and his father whiled away many hours fishing from the coquina rock outcroppings.

So far Moorefield has a theory about the erosion at Fort Fisher. He is the first to admit that it is an unorthodox one. He believes that the layers of coquina rock which make this unique among North Carolina's beaches are the culprits in the erosion process. Many scientists, on the other hand, contend that the outcroppings have protected the beach from more rapid erosion, just as a sand bar might.

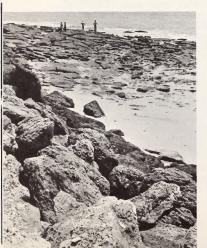
But there are other factors that Moorefield believes might be influencing the erosion of Fort Fisher. The fact that the fort with its massive mounds built of sand and sod stretched a mile along the beach might have also contributed to the erosion. The capricious New Inlet, a mile and a half south of Fort Fisher, has opened and closed several times in the past 200 years, causing shifting sand and currents.

Not all of Moorefield's work is confined to the shore. With the help of a team of divers from the Fort Fisher Marine Preservation Lab, he has located submerged outcroppings of coquina rock running about 1000 feet to the south of the visible exposure. Other large outcroppings of coquina have been found in Snow's Cut and between the cut and Fort Fisher. That may indicate that there is a long linear deposit of coquina, he noted.

Moorefield points out that there are two possible origins of the coquina rock. The sediment could have been a beach deposit during the Pliestocene period or part of a shoal, similar to Frying Pan Shoals that now lies off the Fort Fisher coast. Moorefield favors the latter theory. The coquina, he explained, is a mixture of sand, pebbles and shells which were stirred up by the high energy level near the shoal. When sea level receeded, ground water probably dissolved the shells, which formed a cement to bind the elements together.

Moorefield's completed study and maps could provide a sound base of geology for planning erosion control of Fort Fisher.

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UNIVERSITY OF NORTH CAROLINA



SEA GRANT COLLEGE NEWSLETTER

September, 1977

1235 Burlington Laboratories NCSU, Raleigh, N.C. 27607 Tel: (919) 737-2454

The underutilized fish market

Creating demand for a plentiful supply



Two pounds of minced fish tissue mixed with eleven ounces of dry milk, liquid artificial smoke and miscellaneous spices, baked in a hot oven for 45 to 50 minutes. . .

While this curious concoction for fish luncheon loaf may not sound as exotic as James Beard's Shrimp dé Jonghe, it does have a special meaning to nutrition experts, budget-minded consumers and to the fishermen of North Carolina. What do these three groups have in common? According to seafood researchers, fish luncheon loaf is just one of the many ways in which presently "underutilized" fish species such as the croaker, spot, mullet, Spanish mackerel and grey trout, could be used to provide a low cost, low fat, high protein food product, while creating a ready market for resources currently left at sea.

Representatives from virtually every segment of the seafood industry are beginning to perk up their ears at the word *underatilized* as researchers in North Carolina and other coastal states examine the marketing potential for underutilized fish species at home and abroad.

Nearly every time that a fisherman retrieves his nets, various non-target or incidential fish are caught. These are species that the fisherman is not particularly interested in because of size or because the fish will not bring a high enough return on the market. What the fisherman then does with these incidential fish varies from boat to boat. He either throws the fish back overboard or packs them on ice as he would the target catch.

Although figures vary, one estimate concludes that along the north central Gulf coast (including Alabama, Mississippi, and Louisiana), nearly 19 pounds of finfish are thrown overboard for every pound of shrimp caught. That means that approx-

Processing and promotion . . .

(Continued from p. 1)

imately 750 million pounds of fish are discarded annually. A study by the North Carolina Division of Marine Fisheries indicates that some 4.6 to 6.3 pounds of fish are discarded for every pound of shrimp caught along Pamlico Sound.

Do these fish have to be wasted? Sea Grant marine advisory agent Skipper Crow doesn't think so. He views discarded fish as a resource that could be converted into dollars. "I am absolutely convinced," Crow stresses, "that there is no fish today that you can't sell. It's just a matter of promotion."

Like any commodity, the selling of fish is intimately tied to the law of supply and demand. Without demand there is no incentive to create a supply. Though perfectly edible (in fact, delicious), croaker, spot and mullet have never been in high demand because few consumers are aware of their food potential and high protein value. As a result, fishermen have continued to go after the more traditional, higher yield species, such as flounder, shrimp and crab, while croaker and spot have been relegated to



the "underutilized" category. According to Crow, through massive educational and promotional efforts, a significant demand could be created for these species by exposing previously untried markets to the products. He suggests that once one market is created, other "spin-off" markets for other underutilized species will naturally follow suit. Coupled with existing operations, Crow contends these "new" fisheries will stimulate year round job opportunities in regions historically faced with only seasonal employment.

Southeastern coastal marketing specialists are currently working in coordination with the Gulf and South Atlantic Fisheries Development Foundation and the Coastal Plains Regional Commission to explore market possibilities for such underutilized species as croaker, mullet and Spanish mackerel in 18 major Midwestern cities. Preliminary indications suggest the potential is "tremendous." A. Paul Allsbrook, marketing specialist with North Carolina's Department of Commerce, recently returned from a marketing conference in Chicago. He notes that while the potential there is good, the real marketing success will depend upon whether or not North Carolina fishermen are willing to gear up for the kind of product the consumer wants.

"It has to be convenient. A housewife is simply not going to want to bother with a fish in the round." Allsbrook adds, "There is a market for underutilized fish, but it has to be prepared in a particular manner from the consumer's point of view."

Traditionally North Carolina fishermen have gone along with what he terms "the line of least resistance"—simply icing and boxing the fish, and shipping them in the round to the wholesaler. But Allsbrook stresses that to develop a market for certain underutilized species, such as the croaker, the fishermen will have to greatly expand their processing efforts.

Fisherman Charles Jones of Newport agrees with Allsbrook that the keys to the underutilized market are processing and diversification of operations. And while he admits that he will someday have to make this change, he has strong reservations about the half million dollar investment he predicts will be necessary to gear up for processing. "There are so many other ways of making money that we really don't need that market," he explains.

Glenn Hieronymus, who runs an operation out of Wrightsville Beach, thinks that there is great potential in the underutilized fish market. "I'd like to do it," but he adds, "the price of the ice and labor is so high that it's absolutely not feasible to bring it in. . I know I can get 5ε maybe 8ε a pound for it [in the round]. But when they're out there catching shrimp



Boxing the fish on ice: the line of least resistance

for \$2 and \$3 a pound, then it's just not worth going after the small stuff."

The dilemma facing the underutilized fish market is epitomized by these attitudes. Fishermen, discuraged by the low per unit yield from the fish, are reluctant to part with the substantial outlays required to capture the market. Yet in so doing, they are virtually closing the door to a potentially burative market that has been given only minimal attention in the U.S. Interestingly enough, in terms of market potential, shrimp were considered to be underutilized along the North Carolina coast prior to World War II. Today the shrimp fishery is the single most valuable within the state, with a landed value of pearly \$8.2 million in 1976.

Perhaps the greatest potential in the underutilized fish market lies overseas. According to Roger Anderson, executive director of the Gulf and South Atlantic Fisheries Development Foundation, "Export markets will play a very, very important role in the development of these 'underutilized' species." Because markets have already been established in Europe and in the Orient for such domestically underutilized species as squid, eel, skate and dogfish, marketing specialists suggest that greater attention must be even to the export market. In light of the recently extended fisheries jurisdiction, it is apparent that the significance of these markets will increase in the coming decades as new species of fish are exploited.

Fish Loaf: A tale of textures and taste buds

Consumer attraction is the key to selling any product. In the case of underutilized fish, appeal is vital. For more than three years researchers in the NCSU Food Science Department with UNC Sea Grant support have been attempting to perfect an appealing, high protein, low fat food product composed primarily of minced fish tissue. After countless tests, Sea Grant investigator Donald Hamann believes they may have found the key.

Luncheon loaf, as it is appropriately termed, looks and tastes much like common bologna. But that's where all similarities end, for unlike bologna, luncheon loaf contains nearly 50 per cent more protein and less than a third of the calories for an equivalent portion of bologna. And of course there is another important difference—luncheon loaf is comprised almost entirely of deboned croaker tissue.

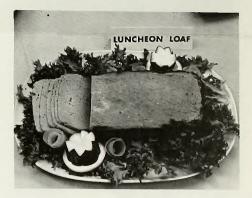
Because croaker are bony fish, filleting can be an aggravating experience for the amateur. Even for the expert, it requires a certain amount of patience and meticulous care. Recovery on filleting averages only 30 per cent. As a result, croaker, like many so-called underutilized species, primarily have been ground into pet food and powdered for use in fertilizer.

Extension Seafood Specialist Frank Thomas views this as an inefficient use of a resource he considers perfectly suited to the human diet. "We look at food for the table as providing a much higher return for the investment than pet food," he remarks. But food researchers

also agree that for any product to be successful in the market place, it must be convenient and the quality must be consistent. This is where research on the minced fish tissue and fish extenders such as the luncheon loaf comes into play.

According to Hamann, one of the primary difficulties involved in producing a consistent seafood product is texture. "The texture of some fish is fairly soft and mushy. This is normally an undesirable situation." Specifically, Hamann breaks the concept of texture down into a series of important properties or "notes": springiness, firmness, cohesiveness, denseness, roughness, gumminess, oiliness and ease of swallow. Two independent panels, composed of professional homemakers with critical palates for seafood, participate in periodic product evaluations. They examine both the textural properties of the products as well as their sensory characteristics: including taste, appearance and odor. After careful scrutiny, the products are ranked on a scale of 1 to 14 for each of the texture notes. For example, a product receiving a 1 for firmness lacks that characteristic. Conversely, a product with a rating of 14 is overly firm.

Of course nothing is left to human error. Texturesensitive instruments are used along with human evaluations. According to Hamann, when the results from both evaluations correlate they are fairly confident of the findings. In addition to texture evaluation, Hamann and his associate researcher C. S. Cheng are examining some of the factors which may account for the broad variation in textural characteristics. Sanitation and rapid chilling aboard ship play a major role in determining whether or not the tissue will have the desired texture. "The length of time the fish are on ice in the boat before it comes to shore affects the texture enormously. If, for example, a ship is at sea for five days,



then the texture will be considerably inferior to that which has been on ice for only one day," Hamann observes.

Both Cheng and Hamann believe the problems with textural inconsistency relate to enzyme activity. Their findings suggest that an enzyme buildup in the fish's tissue while on ice is responsible for the breakdown of certain proteins. From a practical standpoint, this means that the fish's tissues become soft and mushy. However, they believe such texture degradation can be compensated for by rapid heating during final preparation.

Hamann considers the luncheon loaf to be a key product since it is the base for many of the other products developed at the NCSU Food Science Department in Raleigh and the Morehead City Seafood Lab. While researchers hope to apply the techniques developed here to other species, such as spot, bluefish, mullet and grey trout, they have focused most of their efforts on the croaker because of its wide availability in the waters along North Carolina. Last year more than 15 million pounds of croaker were landed off the North Carolina coast.

PROXIMATE COMPOSITION OF CERTAIN SEAFOOOS AND MEAT PRODUCTS

Product	% Protein	% Fat	% Moisture	% Carbohydrate	% Ash	Total Calories Per 100 gms	% Protein Calories Total Calories
Raw Croaker - Minced tissue	17.59	2.00	78.72		1.69	88.36	79.23
Fish Loaf	17.97	2.16	73.11	0.93	5.83	95.04	75.63
Fish Jerky	58.95	7.30	17.00	3.61	13.14	315.94	74.63
Meatloaf	15.90	13.20	64.10	3.30	3.50	195.60	32.52
Frankfurters	12.40	27.20	57.30	1.60	1.50	300.80	16.49
Bologna	12.10	27.50	56.20	1.10	3.10	300.30	16.12
Salami (dry)	23.80	38.10	29.80	1.20	7.10	442.90	21.49

(See "Product," p. 5)

Product consistency is a key ingredient

(Continued from p. 4)

The successful marketing of such seafood products as luncheon loaf may represent an important breakthrough for the budget-conscious consumer. With croaker selling at dockside for approximately 10¢ per pound, products made with croaker could provide a highly nutritious addition to the consumer's diet. And at a price Thomas believes "will compare very favorably with red meat or a similar low fat product." Successful marketing could



Hamann and his texture machine

stimulate interest in and demand for seafood among consumers of all income levels. Hamann warns, however, that no product will sell without product consistency. "We have to assure the buyer that each time he purchases a product he will be getting the same quality time after time. That's what we're working on now."

Studies of minced croaker tissue and other seafood extenders such as fish flakes, jerkies, soups and spreads will continue as researchers continue to explore the myriad ways in which fishery resources can be more effectively and efficiently utilized.

Croaker delights

FISKEBOLLER SOUP

2 lbs. deboned fish meat

2 medium onions

6 cups chicken broth or

3 cups fish broth/3 cups chicken broth

34 cup bread crumbs

1½ tsp. salt

1/8 tsp. pepper

2 eggs

1 carrot, slivered

1 bay leaf

Add carrot slivers and bay leaf to broth and bring to boil. Mix deboned fish meat, eggs, salt, pepper, and bread crumbs together. Form fish mixture into small balls (1½ tsp. each). Place in boiling broth and simmer 10-15 minutes. Sprinkle with dried parsley before serving.

FISH LUNCHEON LOAF

2.2 lbs. frozen deboned fish meat

4 Tbs. nonfat dry milk

1 Tbs. salt

2 Tbs. seafood seasoning

1 tsp. liquid artificial smoke

½ tsp. lemon concentrate

1½ tsp. sage

½ tsp. red pepper

3 drops red food coloring (red #3)

Place frozen deboned fish meat and salt into electric chopper. Chop for four minutes. Add

remaining ingredients and continue chopping until mixture reaches a temperature of 35°F. Spread mixture into two-inch deep baking pans and cook in a hot oven (400°F) for 45 to 50 minutes or until loaf reaches an internal

temperature of 185°F.

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And why not skates and rays?

To the oysterman it is a threat. To the crabber it is a competitor. To the finfisherman it is a nuisance. But to Sea Grant marine advisory agent Skipper Crow and NCSU graduate student Steve Otwell, it is a potentially marketable food item. It is . . . the skate.

While the skate may not be so popular on this side of the Atlantic, in Europe there is no ambivalence when it comes to the skate or his relative, the ray; they are delicacies. Like many underutilized fish species that have never found a market in the U.S., these boneless, "winged" creatures are an accepted and valued item on the European seafood market. In the U.S., however, tremendous quantities of these fish are incidentally caught, discarded, and literally lost at sea

The skate and ray have never had a particularly favorable reputation among coastal fishermen here. Feeding primarily on crabs, mollusks and small fish, these unique fish can also disturb shellfish beds and tear eel grass (a prime habitat area for many fish species) as they propel themselves through the water with a flap of their fleshy, wing-like pectoral fins. Just what impact these activities have on shellfish production is not really known. But Sea Grant advisory agent Crow and researcher Otwell hope to find the answer to some of these questions as they explore export marketing potential for skates and rays.

Crow is doubtful that a domestic market will ever evolve for skates and rays. However, he expresses optimism over the potential for marketing these species in Europe and Japan. Under the funds of a UNC Sea Grant mini-grant, he and Otwell will attempt to assess just how North Carolina fishermen can tie into this export market. Much of the research will center on the quality criteria which must be met before export is possible. "We have to know how the quality of the domestic skate and ray compares with foreign species," Crow explains.

Other criteria such as size requirements, packaging and processing techniques will be thoroughly explored before any test samples are shipped abroad. In addition, by documenting the destruction of oyster and scallop beds by skates and rays, they will attempt to evaluate just how effective marketing could be as a management tool.

Crow stresses that the findings of their research will be "purely preliminary," and that far more indepth studies will be required before actual export can be possible. But if their efforts pan out, the domestically unpopular skate and ray may gain a little more respect in these parts.





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UNIVERSITY OF NORTH CAROLINA



SEA GRANT COLLEGE NEWSLETTER

November, 1977

105 1911 Building NCSU, Raleigh, N.C. 27607 Tel: (919) 737-2454

The loggerhead turtle: fighting for life

The beaches are quiet now. Except for an occasional surf fisherman casting his line in the rosy glow of an early morning sun, or a gull soaring on the currents of a cool, moist, fall breeze, a certain stillness enshrouds the North Carolina coast. The summer's young have already begun their trek to wintering grounds, some thousands of miles away. And a season of rest has replaced a season of productivity.

But for the loggerhead turtle, this summer has been anything but productive, and the fall far from restful. Few adults lived through the treacherous trip to shore during late spring and early summer to lay their eggs in hollow cavities of warm, moist sand. Even fewer hatchlings survived the ordeals of beach incubation and the long mysterious journey back to deep water.

Like many of the once abundant sea turtles, the loggerhead is facing a critical period in its struggle for survival.

Over the last few decades, marine scientists throughout North and South America have observed a sharp decline in the number of sea turtles coming to shore to nest. Today three of the six species of sea turtles found in North American waters are listed on the federal endangered species list.

Because these turtles spend so much of their lives at sea, it is difficult to determine exact population numbers. But scientists with the National Marine Fisheries Service believe that there are fewer than 80,000 leatherback turtles remaining. The picture is even grimmer for the hawksbill and the Atlantic ridley, a species which one researcher observes to be "in dire straits."

Although populations of the green, loggerhead and Pacific ridley turtles aren't in such immediate danger, dramatic declines have been seen in their numbers. A proposal was recently made to include all three on the federal "threatened" list. Approval is expected sometime this year. Such listing would give the turtles far greater protection than they currently have, though not as much as an endangered classification which prohibits any action that endangers the species.

While federal law preempts less stringent state or local laws, numerous states have already moved toward giving the green, loggerhead and Pacific (See "A struggle," p. 2)



A marine at Camp Lejeune places a protective wire cage over a loggerhead nest

A struggle at every stage

(Continued from p. 1)

ridley limited protection. In North Carolina it is "unlawful to willfully take, disturb or destroy any sea turtle including, but not limited to, the green, hawksbill, loggerhead, leatherback, or their nests or eggs." Violation of that statute can result in a fine of up to \$50.

It is no coincidence that the decline in sea turtle populations accompanies a period of rapid development along our coasts. While there are numerous explanations, most revolve around the activities of

man.

The loggerhead is an elusive creature. Though protected by a tough, armor-like carapace, the sea turtle is an awkward and cumbersome animal on land. It seeks stretches of deserted beach on which to make its nests. There is no such thing as second best for the loggerhead. Conditions must be just right if nesting is to be successful.

The ritual of the loggerhead in search of a nesting site is a mysterious yet fascinating sight. In the cover of darkness, the female turtle suddently appears in the surf. She slowly moves shoreward to a point just beyond the water. Here the turtle lowers her head and probes the sand with her nose. From this test she is able to determine whether the sand has the proper consistency and capillary moisture necessary for

nesting and incubation.

If at any point in this process the turtle is disturbed by light or an unusual sound or activity, she immediately rejects the site and retreats back to sea. If the site is to her liking, the turtle awkwardly crawls to a spot above the high tide level and digs a nest for her eggs. An average of 106 eggs are laid. Once the eggs have been deposited, the nest is covered with sand and the turtle returns to the sea, leaving her eggs to incubate a full two months before hatching.

At every stage of life, the loggerhead faces death. On the beach, the eggs are subject to predation by such scavangers as the raccoon, ghost crab and sea gull. On the average, only 65 percent of the eggs survive the incubation period. Once the eggs have hatched, the young turtles must then face still another maze of hurdles as they struggle to return to sea. As temperatures drop with the arrival of night, the tiny reptiles emerge in mass from the nest for a mad scramble to the water. Unlike adult loggerheads which shy away from light, hatchling turtles orient themselves to the light reflected by the ocean. Easily confused, however, the young turtles will unknowingly crawl toward the bright lights of a nearby house or highway. Thus many die in a futile effort to reach the sea.

Adult turtles are frequently caught in shrimp trawls as they make their way shoreward during the nesting season. Because it is illegal in North Carolina for a fisherman to be caught with these turtles, most fishermen throw the hefty 100 to 200-pound reptiles overboard before they dock.

Birkhead and turtle carcass

According to fisherman Lonni Burriss of Carolina Beach, "Most of the turtles are alive when we get 'em." But he notes that it is not uncommon to catch the same turtle over and over again. Exhausted by each encounter, the turtle will literally drown in the nets if the trawls are under water for more than several hours.

Frank Schwartz has studied the loggerhead for many years. Through his work at the University of North Carolina's Institute of Marine Science in Morehead City, he has learned much about the life history of sea turtles and their vulnerability to such environmental factors as temperture and light. According to Schwartz, man is the prime culprit in the

decline of the loggerhead.

Like Schwartz, Bill Birkhead believes that many of the loggerhead's problems are people-related. Birkhead is a research biologist at North Carolina State University's Cape Fear Estuarine Lab in Southport. He first became involved with sea turtles last summer as a pastime. Local police who knew of his interest in turtles began calling him whenever they received reports of dead turtles washing ashore. In a few weeks Birkhead had become the area's resident turtle authority. By August, he had collected a total of eight loggerhead carcasses along a three-mile stretch of Long Beach. According to Birkhead, all of the dead turtles were female and all but one were found in a bloated state without any visible sign of injury. Several other loggerheads were found on the intake screens of the Carolina Power and Light nuclear power plant in Southport, but were later freed and safely returned to open water.

(See "Habitat protection," p. 4)

Unravelling the mystery of seabirds

To most people rarity is a function of how often something is seen. If you don't see it, then its rare or endangered. Simple, right?

Well, for some species like the loggerhead turtle that may be true. But Sea Grant researcher David Lee is finding out that for offshore or pelagic birds, it could well depend on how hard you look.

If you're an avid birdwatcher, you probably know that the sooty tern is usually seen only after a hurricane or violent storm and that the bridled tern is a casual visitor to Atlantic waters. At least that's what it says on page eight of the birder's Bible, Birds of North America.

Yet in five months Lee has already seen record

numbers of both.

With the funds of a UNC Sea Grant mini-grant and the aid of several North Carolina State University zoology graduate students, Lee and his skillful navigator John Booth, Jr. of Manteo, were able to survey waters off Oregon Inlet this summer for offshore birds.

Weather permitting, Lee, Captain Booth, and a crew of three or four "mates" traveled across the inlet out into the Gulf Stream and the edge of the continental shelf. During each trip, birds were identified, counted and collected for further study in the laboratory. Mammal sightings were also recorded. And by the end of the summer, a 50-mile area had been surveyed in a huge gridiron pattern, following the oscillations of the Gulf Stream.

Studying offshore birds and mammals is not a typical afternoon sight-seeing trip. It's a pre-dawn to dusk day of hard work. It means peering through binoculars across endless miles of ocean for even the slightest sign of life flitting across the horizon or rising out of the water. It means standing upright to count a group of birds while your boat is bounced back and forth by rough, choppy seas. And it means ignoring that wave of seasickness as you run along the side of the boat to retrieve a bird.

So why bother?

Lee finds offshore birds and marine mammals fascinating. As curator of birds and mammals at the North Carolina Natural History Museum in Raleigh, he has been studying these species for several years. But it was not until he received additional mini-grant support that he was able to pursue such studies with any degree of regularity.

"Seabirds in general represent our weakest area in knowledge of North American birds," Lee remarks. "Previously, our knowledge of pelagic birds in North Carolina has been limited to dead birds that had washed up on the beach and reports from bird watchers." Because of this informational void, Lee sees the offshore system as "virgin territory—you're starting from ground zero so almost anything you find is new."

Of course there are some legitimate reasons why offshore birds have been neglected in the past. For one thing they aren't very accessible. Most seabirds migrate along the continental shelf where upwellings bring nutrient-laden waters to the surface. As a result, surveying can be an expensive proposition. Lee paid an average of \$240 per trip to charter a boat. Multiply that cost by several trips and it adds up to a lot in a hurry.

Equally important, surveying is time consuming. Most of the pelagic birds seen near North Carolina breed in either the tropics or on the arctic tundra. To complicate things, migration periods vary from species to species. Thus Lee believes year-round censuing is necessary to fully understand the birds'

migration patterns, feeding habits and other life history characteristics.

One more hurdle

And there is still yet another hurdle that Lee has run into—getting well-seasoned birdwatchers to go out on more than one trip. "Eighty per cent of the birdwatchers that I go out with get violently seasick," muses Lee. "And once they get sick, well,

they don't want any part of it."

Despite the adverse conditions, Lee's perseverance has paid off. From black-capped petrels, to Cory's shearwaters, bridled terns, sandwich terns, and albatrosses, he's seen them all. And he is discovering that for pelagic birds, North Carolina waters are among the most productive in the Atlantic. "On a typical trip you would see five to ten species that you wouldn't see from the beach . . . We are seeing more tropical stuff up here than they are off of Florida." According to Lee, the meeting of the Labrador Currents and Gulf Stream off the Outer Banks creates ideal conditions for a diverse mix of both northern and southern species of birds and mammals.

For Lee each trip has been a unique experience. "Each trip I go on I get more and more excited." Probably the most significant finding was made late in September when Booth spotted and collected a white-faced storm petrel about 40 miles off the coast. Though there have been scattered reports of similar sightings in earlier years, Lee notes that this particular species is not officially known in North America. This is the first confirmed observation. He theorizes that the bird may have become lost during a storm and wandered into coastal waters.

Although colder weather has arrived and most of the birds are well on their way to wintering grounds thousands of miles away, Lee is continuing his survey. Little information has been collected on North Carolina's offshore bird fauna in late fall and winter. Lee hopes that the data gathered during these seasons will fill some of the many gaps in our un-

derstanding of pelagic birds.

Habitat protection may be the ultimate key to survival

(Continued from p. 2)

While Birkhead is fairly certain that the bloated turtles were drowned in fishing nets, neither he nor Schwartz believe that the fisherman should shoulder the full blame. "I hate to blame the fisherman," remarks Schwartz. "He's in the picture, but he's not the real kev."

Perhaps Donald Ekberg, a biologist with the National Marine Fisheries Service (NMFS) in St. Petersburg, Florida, best summarizes these observations when he states that "there is no one real cause... there are really several causes." He stresses, however, that the negative impacts of the "encroachment of people on beaches and the disappearance of nesting beaches" continue to be major factors in the turtle's decline.

What does the future hold for these ancient rep-

Scientists are beginning to learn more and more about the habits of the loggerhead and other sea turtles. Until recently little was known about the loggerhead, how long it lived, how often it nested or where it spent the first few years of its life. Today we know that the loggerhead spends at least its first year, previously known as its "lost year," in the Sargasso Sea. And we know that the female returns to her place of birth to lay her own eggs. Such basic information is important to researchers as they look for ways to save the turtle from extinction.

In Pascaguola, Miss., NMFS researchers are testing new trawl equipment that will keep turtles out of nets. One design includes a 12-inch mesh barrier that can be placed across the mouth of a trawl during the nesting season.

In addition, NMFS is helping to teach fishermen what to do if they find unconscious turtles in their nets. According to Ekberg, an unconscious turtle should be placed on the ship's deck, bottom side up. It

should be kept in the shade to avoid sunburn and overexposure to heat. Once the turtle recovers, it should immediately be thrown overboard.

Placement of the loggerhead on the federal "threatened" list is expected to give far greater leverage to efforts to uniformly protect the species. This is especially important to states like North Carolina which currently do no have the financial resources needed to implement a full-blown enforcement program.

Of course not everyone believes that listing is the ultimate panacea. Most researchers agree, however, that preservation of nesting habitat will be the most critical element in saving the loggerhead. Various programs have been launched at both the state and federal level to set aside particularly important sites. At the Marine base at Camp Lejeune, N.C., base biologists Julian Wooten and Charles Peterson are studying the habits of loggerheads who nest along a 14-mile stretch of deserted beach within the camp. Female turtles are watched from safe distances as they move onshore to construct their nests. Once the eggs have been deposited and the nests covered over. the adult turtles are tagged, measured and safely returned to sea. Wire cages are placed over the eggs during incubation to protect them from predators.

Today Camp Lejeune is one of the most active nesting sites in North Carolina. It offers the loggerhead the rare opportunity to nest in relative seclusion—far from the clutter and glare of ocean highways and beachside developments. It offers the loggerhead a chance for survival.

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UNIVERSITY OF NORTH CAROLINA



SEA GRANT COLLEGE NEWSLETTER

December, 1977

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Sea Grant advisory services

A little help from your friends

Last spring Richard Kepley of Carolina Beach ran into some trouble. Kepley had just gotten his commercial fishing operation, Seafood Farms International, underway. His first boat, the 72-foot Theodora, had been completed and was already fishing. But, saddled with a green captain and crew and inadequate rigging, she was having trouble.

Kepley went to Sea Grant's advisory agent in the Wilmington area, Jim Bahen, for help. Bahen turned to the network of Sea Grant advisory agents across the state and nation. Before long, he had Kepley's operation fixed up with an experienced stern trawling captain and more functional rigging.

Bahen is one of Sea Grant's 14-member advisory team. As a fisheries agent, his main job is to work with commercial fishermen. But the team also includes people who are experts in the fields of seafood technology and marketing, eel farming, coastal recreation and land use. Like Bahen, they are dedicated to improving the quality of life on North Carolina's coast. They do that by finding out what the coastal public needs and what they can do to help.

Often that means putting coastal residents in touch with Sea Grant researchers who are studying a particular problem. For instance, Sea Grant advisory (See "Advisory services," page 2)

Advisory services: "the vital connector"

(Continued from page 1)

agent Skipper Crow frequently fields questions from landowners in the Morehead City area who are struggling with erosion problems. He refers them to Ernie Seneca and Steve Broome of NCSU who have successfully used grasses to deter erosion.

Sometimes, the agents come up with a problem that serves as the impetus for a new research project. That's how Sea Grant got involved in a study which led to the development of a new and better procedure for detecting enteric viruses in seafood. Owners of crab plants in coastal North Carolina complained to agents at the Seafood Lab in Morehead City about the short shelf life of their canned blue crab meat. Researchers discovered that the reason was a high bacteria level that wasn't being detected by standard methods.

"The connector" is how Sea Grant's director B. J. Copeland describes the advisory service program. It's the link between the people of coastal North Carolina and the researchers on university campuses.

But no advisory service agent sits around waiting for researchers to come up with the answers. As experts in their fields, they've got the knowledge and know-how to tackle a host of problems. Often they seek out the individuals and businesses who could profit from their experience. Agent Hughes Tillett. for example, has helped to make life a little easier for commercial fishermen in the Manteo area. Several years ago he began introducing hydraulic-powered equipment. Now many fishermen have replaced their manual gear with the more efficient hydraulic gear.

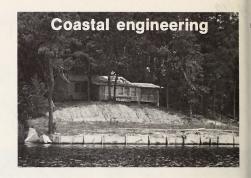
The Sea Grant advisory services program is growing. We will be starting off the new year by hiring a

full-time director of advisory services.

But advisory agents can't work in a vacuum. Their good work depends upon constant contact with the people who live, work, play and do business in coastal North Carolina, The names, addresses and phone numbers of each member of the team are listed in this newsletter. Give them a call.



Agent Skipper Crow



Parts of North Carolina's coastline are eroding at a whopping rate of 15 to 20 feet per year. That adds up to significant losses for those who own land along our estuaries and ocean. In many cases, though, the landowner doesn't have to sit by and watch his land wash away. Wise use of bulkheads or grass and tree plantings can save property.

But it takes know-how to construct an adequate bulkhead. Too often landowners, the victims of inadequate information, put money into poorly designed bulkheads, which actually increase the erosion

problems on their property.

Good, affordable engineering advice is hard to come by in coastal North Carolina, That's where Spencer Rogers comes in. Rogers will join the Sea Grant staff as a specialist in coastal engineering in early March 1978. He has a graduate degree in coastal and oceanographic engineering and is an old hand at working with erosion control structures. Once he's settled in his headquaters at the Marine Resources Center at Fort Fisher, (919/458-5498), he'll be ready to lend a hand to landowners and businesses.

As Rogers sees it, public education is the first real step in solving coastal engineering problems. Ideally, buyers should know something about the erosion potential of their land before they sink a lot of money and hopes in it. Some areas, such as land adjacent to inlets, are known to be danger spots, and Rogers thinks people should be aware of that. He also believes they should know about the special problems of designing construction on the coast. Builders who don't take extra precautions to protect against storms, winds and flooding are asking for trouble.

Private landowners aren't the only ones who have trouble building for the coast. Sedimentation and pollution are currently plaguing dozens of small coastal marinas. The reason: the marinas aren't designed for proper waste circulation. That causes sediments, oil and waste from the boats to get trapped in the basins. Fortunately, there are ways to modify marinas to make them work better.

Rogers will also be available to consult with officers who administer the state's dune protection act and those who will grant permits for development in areas of environmental concern, as recently designated by the Coastal Resources Commission.

Fisheries agents: masters at hat-switching

It doesn't state anywhere in the job description that an advisory agent must know a little about a lot. But if you've worked with marine advisory agents Jim Bahen, Skipper Crow or Hughes Tillett, then you know it's a prerequisite. Although each of the agent's work focuses on the activities of commercial fishermen, they're there to help whoever they can. As a result their job routines are as changeable and unpredictable as the winds.

On a given morning you might find Jim Bahen down on the fishing docks at Carolina Beach helping a fisherman learn how to work a new trawl design. Or you might find Hughes Tillett at Ocracoke helping a clam farmer install some new pens, while Skipper Crow is arranging a meeting between a fish dealer in Morehead City and a wholesaler in Omaha.

By afternoon, Bahen will be handing out new tax law information to fishermen, while Tillett is working on a new hydraulic winch system, and Crow is answering questions over the phone about wild eel harvesting.

Nothing is typical about an advisory agent's day. Hat-switching is the name of the game. According to field supervisor Jim McGee, "In a single day they'll have several roles to play."

It takes a special person to be an advisory agent to North Carolina fishermen. The agent has to know where the fisherman's greatest problems are and how to anticipate his needs. In a sense, the agent is like an information clearinghouse. If he doesn't have the answer to a problem or question right at his finger tips, he'll direct you to someone who does. And if no one else has the answers, then he'll take it upon himself to find out why.

Covering the more than 300 miles of North Carolina coast is no easy task. The thousands of nooks and crannies which characterize the coast make travel time consuming. But travel is extremely important if each agent is to gain the level of visibility that he needs to be effective.

Jim Bahen began his work as fisheries agent last spring. Since then, he's come a long way to gain the respect and confidence of area fishermen. Bahen is headquartered at the Marine Resources Center at Fort Fisher (919/458-5498) and is reponsible for the southern portion of the state. A man of many interests, his primary attention has been focused on gear development and looking at North Carolina fisheries for black sea bass and rock shrimp. Bahen will go to any length to get the information he needs. In the fall he traveled to Oregon for a workshop on the new Loran C navigation system conversion. During the summer he joined forces with the state Department of Commerce to take a group of North Carolina boat builders to Alabama for some stern trawler rigging demonstrations.

Since 1973, Skipper Crow has been a valuable part of Sea Grant's advisory work. He's located at the

Marine Resources Center at Bogue Banks (919/726-0125) and works with fishermen along the central section of the coast, including Morehead City. Along with his many other advisory activities, Crow shows a flair for business management and understanding market mechanisms. He's a real asset to fishermen who need help in tapping new markets, some as far away as Memphis and Kansas City, and learning about the potential for underutilized species.

For Hughes Tillett, exposure is not a problem. Tillett is a well-seasoned agent whose early years as a commercial fisherman make his face a familiar site at the docks. Tillett is based at the Marine Resources Center in Manteo (919/473-3937) and covers the entire northern section of the coast, including the Outer Banks. Like all Sea Grant agents, he dabbles in a number of projects. But Tillett is particularly well versed in clam and oyster culture, hydraulics, and pot and trap development. If he's not answering the barrage of requests for information, he's in the field helping small-time fishermen install hydraulic pot pullers, demonstrating the versatility of the floating pound net, or updating a hang log which will eventually cover the entire North Carolina coast.

Our fisheries agents make up a pretty incredible team. We think they're hard to stump. If you have a question or a problem you think they can help with, don't hesitate to give them a call.



Walt Jones (left) explains eel feeding techniques

Down on the eel farm

Down on the farm in New Bern, the eels are getting fatter and tastier by the year. That's what the experts said when Sea Grant's cultured eels were submitted to taste tests in two Japanese restaurants in New York this year.

It was just one of many encouraging signs that Walt Jones, John Foster and Bill Rickards got on the operation of their experimental eel farm. Now in its fourth year, the eel farm was established to see if the American cel could be profitably raised in eastern North Carolina. So far, the prospects look good. These skinny fish are in demand in the Orient and Europe, where they are considered real delicacies.

The eels are frequently harvested from outdoor ponds to be tested and weighed. With the special diet and feeding techniques developed at the farm, the eels have consistently reached a marketable size of one-quarter to one-half pounds in an average of 18 months. In the wild, that kind of growth takes about four to five years. Each spring the ponds are restocked with young eels or elvers which Jones and Foster trap in nearby rivers.

During 1978 the researchers will be trying to find out how much fishing of adult eels or elvers can be done without endangering the population. This study is especially important because of the development of an eel fishing industry in North Carolina over the past several years. With the help of Sca Grant advisory agents, it has become lucrative part-time work for about 350 fishermen.

The eel farm is a demonstration project, so Jones and Foster welcome visitors. If you'd like to see how the operation works, give them a call in New Bern 919/633-0414. Rickards, director of the project, also serves as associate director of the Sea Grant Program. He can be reached at 919/737-2454 on the N. C. State University campus.

Land use planning: key to the wise development of our coast

Land use planning for our coastal areas is not the kind of academic issue that is better left to the politicians. It's essential to the everyday life of all communities. Only good planning will assure a healthy balance of unpolluted recreation space and sufficient land for orderly development.

In short, it's everybody's business. That's why Simon Baker, Sea Grant's land use specialist, has recently turned his attentions to public education. Baker believes that if people are to help make wise decisions, they need to know something about the environmental and economic issues at stake.

Last year Baker and graduate student Les Thornbury produced a 30-minute color documentary film designed to do just that. "An Act To Protect" examines the landmark Coastal Area Management Act and the problems which led to its passage in 1974. So far, it has been presented over the UNC-TV network twice. Copies of the film are now available for viewing by individuals and groups. If you're interested, call or write Baker at the Sea Grant headquarters on the N. C. State University campus (919/737-2454).

Baker also helped to design a poster on the state's commercial fisheries for North Carolina's school



children and authored "A Citizen's Guide to North Carolina's Shifting Inlets." This book of aerial photographs tells the story of the migration of our 23 active inlets.

An expert in aerial photography, Baker just put his skills to work on a project that could prove crucial in the aftermath of a major coastal storm. Working with the Raleigh squadron of the Civil Air Patrol, he took a series of 440 oblique angle slides of all 320 miles of North Carolina's coastline. By comparing these slides with those taken right after a coastal storm, the staff of the Division of Civil Preparedness in Raleigh will be able to make speedy assessment of damage. That could mean that aid will get to the stricken area sooner.

During 1978 Baker is going to try to bring the problems of the coast to the attention of those who live in inland areas. That's because he's convinced that some of the major users of the coast live in other sections of the state most of the year. Headlining his plans is a series of two-day coastal film festivals which will be presented on university campuses all over the state.

Seafood agents

Upgrading North Carolina's industry

Until just a few years ago, the most sophisticated fish processing house in North Carolina did nothing more than ice and box fresh fish in the round. For the most part these simple operations were conducted in ramshackle wooden buildings.

The North Carolina seafood industry has come a long way since then. Now there are at least ten plants on the coast where fish filleting is routine. That means more jobs for residents and more money for processors. And the work is done in modernized plants with refrigerator rooms and concrete floors.

Sea Grant has been part of that change. At the Seafood Lab in Morehead City, Sea Grant agents and specialists have consistently explored new technology for marketing and processing that they can pass on to the seafood industry. The staff at the Seafood Lab already has quite a track record for helping the industry. Agent Dave Hill has helped processors to make multi-million dollar design changes in their plants which mean more efficient, sanitary service. At the same time, agent Joyce Taylor has worked to amass an extensive seafood information center, full of technological information for fishermen and processors.

Packaging seafoods

The folks at the Seafood Lab have also done extensive work on packaging techniques that may help in the marketing of seafood. Vacuum packaging and family-size packages of frozen seafood for tourists are just two ideas that have caught on with the state's processors and retailers.

Sometimes it's necessary to back up advisory services work with scientific experiments. The staff of the Seafood Lab has worked hand in hand with scientists at the Food Science Department of N.C. State University to develop some new products that put to use trash or underutilized fish. They hope that the developments will eventually mean more profit for fishermen and processors and high protein, low fat products for consumers. So far, most of the products they have developed are based on croaker - a fish that is caught in abundance off our coast but traditionally brings a low price for fishermen. On the new product list are fish luncheon loaf, sea pups (fish hot dogs), fish spread and fish jerky.

Decreasing bacteria

This year the folks at the Seafood Lab will be working hard to improve sanitation on commercial fishing boats and in processing plants. They will be trying to find inexpensive ways of reducing bacterial levels. They'll also be helping fish processors to bring their plants in line with new federal regulations on discharge of wastes.

There's another unique project that Sea Grant is sponsoring this year. Steve Otwell of the Food



Agent Dave Hill (right) works with fish deboning machine

Science Department at NCSU and advisory agent Skipper Crow will be trying to find a solution to an old problem that nags fishermen: skates and rays. These creatures are notorious for tearing up fishermen's nets and for destroying shellfish beds. Crow and Otwell will be working with the staff of the N.C. Division of Marine Fisheries and a group of fishermen to see if it's feasible to catch and sell skates and rays for food. In Europe, they're considered delicacies.

Joyce Taylor and Dave Hill will be joined by a new specialist at the Seafood Lab in Morehead City early in 1978. They'll all be glad to answer questions anytime. Give them a call at (919/726-7341).

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Recreation

Recreation is big business along the North Carolina coast. The state's unique system of barrier islands, coastal wetlands, sandy beaches and expansive sounds brings thousands of visitors to its shores every year. Today, coastal recreation is one of the fastest growing industries in North Carolina.

While such growth can provide a healthy boost to the state's economy, it can also pose some serious management problems. And that's where Sea Grant specialist Leon Abbas and agent Dennis Regan enter the picture. Both are trained in recreation management. Both want to make sure that recreational development along the North Carolina coast doesn't follow the same thorny path it has in other, more developed states. In essence, they want to help the state maximize its recreational use of the coast, while minimizing the damages these uses can have on a highly sensitive system.

If that sounds like a mouthful that's because it is. "Marine recreation is a function of the natural resource, in this case, the coastal zone" observes Abbas. As a result, there is enormous potential for competition and conflict between uses. According to Regan, the coastal zone is like any other natural resource. If too many demands are placed on it, then the result is over-use and eventual abuse.

Abbas and Regan hope to avoid some of the mistakes made by other states in their coastal development. For one thing, they're spending a lot of time learning about the marine recreation industry of North Carolina and the unique needs of its suppliers and users.

An economist by training, Abbas is interested in the economic profile of the recreation industry. He has just completed a descriptive survey of all the coastal marinas in the state and is beginning work on a similar study of the charter boat industry. This spring, Abbas has lined up a series of recreational lectures that are guaranteed to whet anyone's appetite for a visit to the coast. They include such topics as birdwatching, sailing and salt water fishing.

Regan is the most recent addition to the Sea Grant advisory team. His focus is on recreation and the many unexplored opportunities that can be found in the coastal zone. For example, he's working with community residents in planning a bicycle trail along the Outer Banks. And he's developing a directory of SCUBA diving sites in North Carolina, studying the financial feasibility of dry stack boat storage and laying the groundwork for a boating safety and navigation workshop in the spring.

When they're not busy planning a workshop or conducting a survey, Abbas and Regan are hard at work preparing recreational guides to the North Carolina coast. Two guides are already in the works: a series of sports fishing maps and a seasonal weather guide.

Like the entire Sea Grant team, Abbas and Regan are interested in people. They're happy to answer any questions you might have. And if you have an idea about coastal recreation, give them a call. They're excellent sounding boards. Abbas is located at the Sea Grant office in Raleigh (919/737-2454) and Regan is headquartered at the Marine Resources Center in Manteo (919/473-3937).



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UNIVERSITY OF NORTH CAROLINA

SEA GRANT COLLEGE NEWSLETTER

January, 1978

105 1911 Building NCSU, Raleigh, N.C. 27607 Tel. (919) 737-2454



Since the dawn of civilization, the ocean has been the life-blood of mankind. Early life grew and prospered along its edges. As a source of food, travel, worship, and even superstition, the ocean played a vital role in the shaping of human culture.

Today civilization extends far beyond the coastal fringe, across the plains and into the mountains. Yet despite this landward movement, the ocean continues to be one of our most important resources.

When Sea Grant first began its work in North Carolina eight years ago it seemed to us that our researchers would never run out of things to do. And we were right.

Today North Carolina Sea Grant is looking into more areas of research than ever before. We're constantly evolving and expanding our program in an effort to keep pace with the changing needs of the coastal community. Our team of advisory agents helps us locate areas where research is needed and then takes the information to those people who can use it the most. As a result, we've got our hands into everything—from new fish products and shoreline erosion, to septic tanks, disease in aquaculture, ocean outfall and the sociocultural organization of a coastal fishing community.

January is an important month for Sea Grant. After a careful review by various state agencies and the Office of Sea Grant in Washington, D.C., our proposals have become plans, and the gears are already turning for a new year of study. Equipped with an army of biologists, chemists, economists, engineers, lawyers and sociologists scattered throughout the campuses of the University of North Carolina, Sea Grant promises to be anything but dull in 1978.

Seafood studies: ocean to platter

Chances are that a growing portion of the protein you eat in the next decade will come from the sea.

To some people that statement may come as a shock. But to others, it's no surprise. The protein shortage facing the world is reaching crises proportions. Our dwindling land resources simply cannot adequately support the appetite of an expanding population. As a result, we are beginning to rely more and more on the ocean and the bounties within it.

At Sea Grant, researchers are hard at work finding new and better ways to use these food resources. They're exploring new foods and perfecting old ones. They're making seafood safer to eat and easier to prepare. And they're studying the economics of the seafood industry to see how to make it more attractive to the pocketbooks of the consumer and the fisherman.

If you've heard of the sea pup or fish jerky, then you've heard about Don Hamann of NCSU and his work with minced fish tissue. Hamann's work is not only finding new uses for fish, but ways to reduce the breakdown of tissue proteins during cooking. And that's important. It means the fish products you eat will be far more nutritious and at a price that's right. In the past Hamann has confined most of his research to croaker, an abundant but little used fish. But this year plans call for work with other underutilized species, such as porgy and spot.

Of course not all of Sea Grant's work is with "traditional" fish. You've probably seen eels in some of the state's coastal rivers and estuaries. But did you know that these snakelike, bony fish are culinary delights in the Orient and in certain regions of Europe? Bill Rickards of NCSU has been involved with the culture of these creatures for several years. In that time, he and fellow researchers at the New Bern eel farm have reduced the grow-out period of young eels or elvers from four years to eighteen months. There are still many questions that have to be answered before eel culture can be given the green flag. The economic feasibility of commercial culture operations still remains uncertain. And population studies are necessary before scientists can determine what impact large-scale eel harvest will have on wild populations. Rickards will continue to work this year on answering some of these unknowns.

In the meantime, additional support has been called in. No fishery study is complete without a market survey. Ed Leonard of NCSU will be expanding economic research begun last fall into a full-blown project this year. He'll be examining the locations, types and sizes of markets for cultured eels both here in the U.S. and abroad. From the information he collects, he hopes to come up with some pricequantity figures that will be of benefit to fishermen thinking about entering the eel culture business.

In some areas of aquaculture, the economic picture is far more promising. That is, unless disease becomes a problem. For most aquaculturists disease is a fact of life. It is a constant threat that, if it progresses too far, can wipe out an entire operation.

Chuck Bland of East Carolina University has done a lot to help out area aquaculturists in their effort to win the fight against fungal diseases. Most of his work has involved diseases affecting shrimp culture.

But many of his findings are being used in other areas of aquaculture. This year Bland will continue to study the biology of these diseases, their controls, and the impact these controls have on crustacea tissue. He also plans to prepare a handbook on the detection of various fungal diseases and their treatment.

Just as disease is a problem in aquaculture, contamination of seafood during processing, packaging and storage is another hurdle the seafood industry must overcome. In North Carolina today processing

(See "From seaweed," page 5)



Basket containing elvers



Teachers on Harkers Island field trip

Marine education

Education is one of Sea Grant's primary functions. The way we see it, the more people know about the coast and the marine environment, the easier our jobs become. That's one reason we're working to build up our marine education program at all levels.

Last summer Sea Grant money supported a month-long educational workshop for 23 middle school teachers (grades 4-8). The workshop, appropriately titled "Man and the Seacoast-Past and Future Perspectives," was used to develop marine instruction and teaching materials to be used in middle schools as part of their regular science curricula. In another project, a group of six teachers prepared study plans for a marine science education program. Under the direction of Dirk Frankenberg of UNC at Chapel Hill, work will continue this year to assimilate the workshop material and study plans into a series of teachers' guides. The guides will cover a variety of coastal topics, including geology, oceanography, anthropology and economics, and will include lesson plans and field study ideas.

On the university level, Tom Schoenbaum of UNC at Chapel Hill is continuing his work toward establishing an ocean and coastal law and policy program at the University of North Carolina. The program is designed to help law students, coastal planners and scientists understand the complex maze of state and federal laws which govern our use and management of the coastal zone. As part of the program. Schoenbaum instructed a five-week course last summer on ocean and coastal law policy. A lengthy text was prepared as a guide to the course, highlighting areas of conflict in coastal law. This summer, Schoenbaum will again teach the course and will involve students in legal research on topics that are of direct concern to North Carolina and its coastal and ocean resources.

Estuarine studies

Researchers take a look at pollution problems

Estuaries are ecologically unique places where salt water from the ocean mingles with fresh waters from streams and rivers. The result is an area rich in nutrients which is the crucial nursery for most of the state's commercially important fish and shellfish. Boaters and fishermen know it is a prime recreational territory. And along our estuarine shores lies some of the most valuable real estate in coastal North Carolina.

It's no wonder that pollution of these waters causes concern in many quarters. Sewage contamination from increased development on adjacent lands is partially to blame. More than 80 percent of North Carolina's coastal soil is not suitable for conventional septic systems. Working with Sea Grant funding, Bobby Carlile of NCSU has developed several alternative septic systems that have already solved problems in some coastal areas. Carlile will continue testing and improving the new systems this year.

Septic tank pollution is one of the factors which led to the continued closing of 448,098 acres of North Carolina's shellfishing waters last year. The judgments about which waters to close were based on standard tests which determine levels of bacteria. But Sea Grant researcher Mark Sobsev of UNC at Chapel Hill believes that the standard tests are not good indicators of viral contamination which cause diseases such as hepetitus and polio. In 1977 he perfected a new test for virus contamination. This year he'll be trying to establish the relationship between sewage contamination and enteric virus levels in oysters. One possible option for making more oysters suitable for marketing is to transfer them from polluted to uncontaminated waters, where they can cleanse themselves. Sobsev will be looking at that process to see how long it might take and what conditions it will require.

Another seafood that has piqued the interest of many in recent years is the brackish water rangia clam, which is abundant in North Carolina's estuaries. The state's only venture with commercial harvesting of this clam was aborted in the early 1970s when a shipment failed to meet bacteriological standards for interstate commerce. But in recent years the state's seafood industry has expressed a renewed interest in the marketing potential of the rangia clam. Bernard Kane of East Carolina University will continue work that he began last year to find out if the high standard plate counts have any real public health significance. Early results show that there may be conditions or seasons during which the clam may be safely harvested for consumption.

Human waste isn't the only kind of estuarine pollution that concerns scientists. All across the country, industries are dumping chemical by-products into streams and rivers. The effects of these chemicals on marine life are, in many cases, unclear. In North Carolina, a major phosphate operation on the Pamlico River releases fluoride as a by-product. With Sea Grant funding, Edgar Heckel of East Carolina University is trying to determine whether fluoride affects the molting of the blue crab, one of the state's



Royal tern colony



Septic tanks create coastal problems

most valuable seafoods. If it is found to significantly influence the population, federal and state regulations concerning effluents will need to be reexamined.

It's no secret that the condition of bird populations can tell the real story about the health of their environments. But in North Carolina, as in many other areas, scientists have been thwarted because they don't have accurate population counts of coastal birds. Jim Parnell of UNC at Wilmington and Bob Soots of Campbell College have been trying to change that picture. Last year they completed the second annual census of sea birds and wading birds which nest in colonies on the North Carolina coast. It's the first census of its kind and will provide a base for studying the birds in the future. This year Parnell and Soots will finish up an atlas which will provide detailed information about each colony and its nesting sites. Already their studies have made a difference in the way the U.S. Army Corps of Engineers manages dredge spoil islands, which are nesting sites for 85 percent of the state's colonial birds.

Every year flooding of estuarine waters causes loss of property in North Carolina. Some of it takes place on the shores of the Pamlico Sound, the largest body of water in North Carolina. This year Bob Weisberg. Len Pietrafesa and Jerry Janowitz of NCSU will measure the effects of wind on sea level in Pamlico Sound in order to understand the sound's circulation patterns. Their goal is to make accurate predictions of storm surge and erosion by the time the study is completed in 1980. This information could prove important to the Division of Civil Preparedness in planning for evacuation of areas surrounding the sound.

Then there's the case of Eurasian watermilfoil in Currituck Sound. Last year Sea Grant responded to loud complaints from residents of the area who claimed the aquatic weed bred mosquitoes, tangled fishing lines, clogged boat motors and made life generally unpleasant on some parts of the sound. Several Sea Grant researchers tackled the problem, trying to find the facts in the case. One preliminary report has already been made to area residents and the study goes on. Graham Davis of East Carolina University will continue his studies of growth control techniques, including experimental mechanical mowing of milfoil. He'll also be taking a look at possible commercial uses for the weed. Mel Huish and Howard Kerby of NCSU will expand their studies of the impact of milfoil on the vital black bass and commercial fisheries in the area.

Coastal studies

Nowhere is the power of nature more evident than at the edge of the ocean, where the dramatic forces of wind and water often play havoc with man's construction. Many North Carolinians have experienced the blows of erosion and storm damage.

Ever since it got underway in North Carolina, Sea Grant has worked at helping coastal residents deal with the problems of erosion and storm damage. Last year, for instance, three NCSU scientists, Ernie Seneca, Steve Broome and Ernie Knowles, came up with some simple ways of retarding shoreline erosion. They successfully slowed erosion in several areas of the state by planting economical and attractive marsh grass. This year they will gather data from gauges installed at several eroding sites to measure wave forces. That information will help to set up guidelines for determining where grass plantings might be successful.

Some of the most devastating damage to property can be attributed to ocean overwash. Overwash occurs when high walls of water breach the sand dunes and invade coastal land. Paul Hosier and Bill Cleary of UNC at Wilmington began a Sea Grant project last year which indicates that certain areas of the coast are more vulnerable to overwash than others. This year they will publish a series of maps delineating the history of overwash from Cape Lookout to Cape Fear since 1938. They're also developing a survey technique which will enable a trained person to offer an analysis of overwash hazards to prospective builders.

Sea Grant is sponsoring one new project which should help coastal residents make wise decisions about construction on the coast. Jerry Machemehl of NCSU will determine which areas of the coast are most likely to be hit by storms. He'll take a hard look at the types of structures now used in those areas and decide the risk to life and property. All of this information will go onto maps of hazard zones. Machemehl plans to recommend improved building practices for new state building codes.

Disposal of human wastes is a special problem in areas immediately adjacent to the ocean. The land is already overtaxed by septic tank systems. As more tourists flock to the beaches, the problem is likely to become more acute. One possible alternative to the present inadequate septic systems is ocean disposal of wastes through an ocean outfall system. But we need to know what the costs of that solution will be—both financial and environmental. Yates Sorrell of NCSU will continue his efforts to work out a method which engineers can use to evaluate outfall designs for the North Carolina coast. Sorrell's work is part of a larger study on ocean outfalls being funded by the state of North Carolina.

Increased development on the coast of North Carolina brings other kinds of pressures, too. It forces coastal governments to plan for the kind of growth they want in the future. Under the 1974 Coastal Area Management Act, all coastal counties are required to draw up land use plans. David Brower of UNC at Chapel Hill believes that this type of decision is especially rough for the largely rural and coastal sections of the state. Many of these areas have small permanent populations and limited fiscal and staff resources. This year Brower will draw up guidelines designed to make the job easier for elected officials and land planners in these regions.



From seaweed to sociology

(Continued from page 2)

plants are a far cry from the run-down shacks of ten years ago. But despite these improvements, pathogenic bacteria are still present in some products. And they pose some real public health hazards. According to NCSU researcher Marvin Speck, much of the problem lies with inadequate detection methods. Because these bacteria go undetected, little is done to improve or correct the conditions which cause the contamination in the first place. This year Speck will continue to work with individual seafood processing plants to help pinpoint sources of contamination. And he'll be refining methods he has developed to improve detection of harmful bacteria and enhance the overall shelf-life of certain products.

According to researcher Donald Kapraun of UNC at Wilmington, stalking the wild nori is not such a far-fetched idea. Nori is a lettuce-like marine algae found along the southeastern coast of North Carolina. A similar species is cultured, harvested and eaten in large quantities in Japan. Its high mineral, protein and vitamin content make it a particularly attractive diet supplement. While it is not currently popular in the U.S., some researchers believe it could be. This year Kapraun will be trying to assess nori populations in North Carolina coastal waters to determine whether commercial harvest of the plant is feasible.

Understanding North Carolina's fishery resources and planning for their use do not always involve the traditional sciences. An understanding of those people for whom fishing and the ocean is a way of life can provide some valuable insights into how these resources should be managed. This year marks an important new direction for Sea Grant. James Sabella

of UNC at Wilmington is launching a study of the sociocultural organization of a North Carolina fishing community, Harker's Island. In a nutshell, Sabella and his associates will be examining the life styles of Harker's Island inhabitants—their ancestries, their attitudes and values, their work styles, their social organizations, their levels of education and income, and their attitude toward resource management. The results of this study are expected to fill an important void in our understanding of the North Carolina coast.

Our most recent annual report outlines advances made by Sea Grant researchers and advisory agents during the 1976 year. If you'd like to receive a free copy of the report or be added to our newsletter mailing list, just fill in the form below and return it to: Sea Grant, Box 5001, Raleigh, N.C. 27650.

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February, 1978

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Aquaculture: feeling the pains of growth

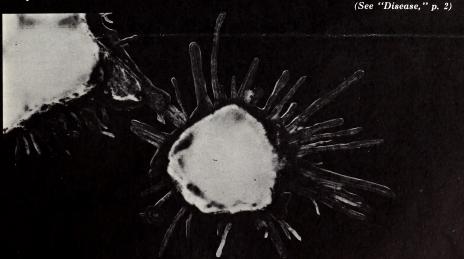
It has often been said that aquaculture is the agriculture of a hundred years ago. In a sense it is a form of farming. Simply stated, aquaculture is the raising of aquatic plants and animals under controlled conditions.

But there are some aspects of aquaculture that make it more complicated than that. For one thing aquaculture deals exclusively with the aquatic environment. Though water is the basic element of life, we know far more about soil and land crops than we do about aquatic systems and the creatures which inhabit them. And that poses some unique problems for aquaculturists.

In aquaculture there are no pat answers to engineering and design questions. Every culture operation has its own needs and problems. Even the quirks in growth rates and feeding habits among cultured species differ from operation to operation. As with any new commodity, certain market questions must be answered before investment even begins to make sense. "Aquaculture is the integration of engineering with biological principles," observes UNC Sea Grant Associate Director Bill Rickards. "Making a successful marriage out of that takes a lot of time and commitment."

Even after these stumbling blocks have been pushed out of the way, there's still at least one other hurdle that may never be completely overcome. Disease is a fact of life for just about any farmer. And for the aquaculturist it's no exception.

Whenever an organism is grown in high densities the potential for disease is greatly intensified. Crowded conditions stress the organism, leaving it weakened and susceptible to disease. Once started these diseases spread like wildfire. Among humans, they're known as epidemics. In aquaculture, they can spell financial disaster.



Disease can spell disaster

(Continued from p. 1)

Two years ago a shrimp culture operation in Honduras was on the verge of bankruptcy. For six months production had come to a virtual standstill. A persistent problem with fungal disease was rapidly gobbling up profits.

After local efforts to pinpoint the source of the disease failed, company officials turned to Sea Grant researcher Chuck Bland of East Carolina University for help. With his guidance they were able to clear up the disease and get production rolling again.

Bland is a mycologist by training. Over the last seven years he has become an authority on the many fungal diseases which affect cultured crustacea. His work with shrimp, crab and lobster has shed light not only on the biology of these diseases but on possible controls.



Bland (left) and graduate researcher Laddie Crisp

According to Bland, pathogenic fungi enter culture operations in basically two ways. They are either introduced via the water system or carried in by captured wild stock. Once in the system, the fungi multiply and infect the cultured organisms, breaking down their muscle tissue and eventually killing them.

Bland believes that filtration and chlorination of the water system are essential steps in reducing the incidence of fungal attack. But, he warns, water treatment alone is no guarantee that the fungus will be controlled. "Some sort of treatment of the organism is necessary," Bland emphasizes.

Currently Bland is testing various chemicals to see how well they work as fungicides on cultured crustacea. To date his most encouraging work has been with a chemical compound known as malachite green.

Researchers have known for some time that the chemical is effective in controlling fungal diseases in fish culture. Bland was the first to confirm its effectiveness on crustacea. Although no one is certain how the chemical works, Bland speculates that it somehow interferes with fungal respiration. Today it is successfully being used as a fungal disease control in experimental hatchery situations.

But because malachite green has been implicated as a possible carcinogen, the Food and Drug Administration will not authorize its use in commercial operations. As a result, Bland is also looking into other chemical treatments that may have greater potential for FDA approval.

Of course he hasn't given up on malachite green. "I'm still a little bit hopeful for it," admits Bland. Through cooperative work with the University of Arizona's Environmental Research Lab, he is using radioactively labeled malachite green to trace chemical residues in shrimp tissue 24 and 48 hours after treatment. Results from preliminary tests indicate that there is no buildup of the chemical. If further testing confirms these findings, then malachite green may have some potential use in the future for disease control.

To help aquaculturists concerned about fungal diseases, Bland is also preparing a handbook on the diagnosis and treatment of fungal diseases affecting crustacean culture. According to Bland, the handbook has a two-fold purpose. First, it will help aquaculturists recognize the more common diseases. Secondly, it will tell them how to prepare and ship specimens to labs for diagnosis and valuable treatment information.

Although Bland believes disease control is a critical step in eliminating many of the economic uncertainties of aquaculture, he is doubtful that the problems of disease will ever completely disappear. Viral, nutritional and bacterial diseases still wreak havoe with many culture operations. Finding treatments for them involves many of the same difficulties as fungal disease control.

"Two years ago I would say that fungal disease was the most important factor in limiting the development and success of crustacean aquaculture. Today viral disease is probably the biggest problem. . I don't think all of the diseases will ever be controlled. Something will always be cropping up," he concludes.

Aquaculture comes of age

Interest in aquaculture is far from being a recent phenomenon. Records dating as far back as 5th century B.C. tell of the work of Chinese philosopher Fantii his efforts to rear carp in man-made ponds.

But it was not until the late 1800s, when biologists first began to notice large declines in various fish populations, that interest in aquaculture began to flourish worldwide. Aquaculture, scientists believed, was the logical way to replenish depleted stocks of wild fish. Eggs could be reared in hatcheries and the young released at sea.

By the 1920s, however, it became obvious that this method could not provide the massive numbers needed to restore these populations. And world interest in aquaculture waned.

Of course not everyone completely gave up on the concept of raising fish under controlled conditions. During the next few decades new techniques were developed, philosophies changed and scientists began to view aquaculture as a way of supplementing rather than replacing wild fisheries.

Over the past 15 years aquaculture has undergone a remarkable transformation. Last year alone, world production through aquaculture approached seven million metric tons.

Today work is being done to culture such species as the abalone, eel, freshwater prawn, crayfish, yellow perch, lobster, oyster, mussel, clam and shrimp. Even carp, tilapia, milkfish, mullet and assorted seaweeds have been the subjects of culture studies. Though the lists are impressive, not all represent viable commercial operations. In many countries, government subsidies are necessary to keep them alive. Probably the biggest money-makers here in the U.S. are trout, salmon and catfish farms. Yet even in these enterprises, profit is not always a certainty.

"While catfish, salmon, and trout are producing money crops," stresses Rickards, "they are still high capital investment and high risk ventures, mainly because we don't have complete control over things such as disease and the physical system."

Because of the economic uncertainties, aquaculture has developed at different rates and in different directions throughout the world.

"Aquaculture's success and role will depend upon the economic system in which it is working," Rickards emphasizes. In Japan, where land is scarce, aquaculture is a sophisticated industry and a vital protein producer. But in the U.S., where wheat fields and cattle ranches still abound, culture operations remain highly individualized and serve primarily as a source of speciality food items.

Despite these differences, aquaculture is here to stay. And it is unlikely that it will ever be placed on the back burner again. Just what role it will play in



Pilot clam and oyster culture project along the Outer Banks

the future, however, remains to be seen. Most researchers agree that aquaculture will never be a substitute for commercial fisheries. Nor will it feed the world's populations. "It's a narrow viewpoint for any educated person to think that the hungry millions of the world could be fed through fish farming given present technology," comments Rickards. But as a source of supplemental food, aquaculture holds great promise.

Currently Sea Grant is sponsoring research throughout the country on various aspects of aquaculture. In North Carolina, biologists are working with an experimental eel farm demonstration facility to determine the biological and economic feasibility of culturing the American eel. An economist is studying worldwide market demands for eels. Along the Outer Banks, marine advisory agents are providing information to individuals who want to set up pilot clam and oyster gardens. Elsewhere in the state, researchers are looking into some of the nuts and bolts of aquaculture, including such areas as disease control and legal constraints. What their research uncovers may ultimately help define and direct the future of aquaculture.



Legal conflicts

Aquaculture's "accidental constraint"

The problems associated with aquaculture are not limited to biology and engineering. At times they extend into the realm of public law. For the person not prepared for these legal encounters, they can be confusing and frustrating ordeals.

Unlike land, water is in the public domain. And that's an important distinction where aquaculture is concerned. There is no ownership of water in the traditional sense of the word. One has only a right to use the resource. These use rights are awarded in the form of permits and are valid only if certain requirements are met.

So how does this involve the aquaculture industry? As a water user, the aquaculturist must abide by the rules and regulations governing the permitting process. According to Tom Schoenbaum of the University of North Carolina's School of Law, many of these requirements have "spin off" regulatory effects on the industry itself. And their impact is to restrict the overall development of aquaculture.

As part of his research with Sea Grant on ocean and coastal law, Schoenbaum is taking a look at many of the regulations which he sees as "accidental contraints on the aquaculture industry."

"Many of these laws are passed to regulate other

activities, but because of the way they are written, they accidentally or incidentially are a legal constraint on the aquaculture industry," he stresses.

According to Schoenbaum there are several areas where conflict can arise. First, many problems are created by the tremendous overlap in regulatory jurisdiction hetween state, federal and local agencies. In a particular culture site along the coast, for example, use permits theoretically might have to be obtained from the federal Environmental Protection Agency for pollutant discharges into waterways, from the Army Corps of Engineers and Coast Guard for work in navigable waters, from the Department of Agriculture for permission to sell aquacultural products, from the state Division of Marine Fisheries to lease bottom lands not already in natural production and from local agencies to meet various building, land use and health codes.

The prospect of dealing with that many agencies is discouraging for just about anyone. As a result, many potential aquaculturists are turned off by the sheer volume of paper work they must go through. This Schoenbaum sees as an unnecessary impediment, which can be avoided.

(See "Changes," p. 6)

Off the presses . . .

Here's a list of Sea Grant's 1977 publications remaining in stock. Residents of North Carolina may receive free single copies, except where a charge is indicated for all requests. Prices for non-residents are listed in parentheses. Please include the publication number(s) with your request. Checks made payable to UNC Sea Grant should accompany orders. Write: UNC Sea Grant, P.O. Box 5001, Raleigh, N.C. 27650.

A very special fish (American shad)

Step-by-step instruction on procedures for cleaning and filleting shad.

by Joyce Taylor and Serena Judy UNC-SG-76-14 (no charge)

Fishery facts at your fingertips

Complete listing of the subject headings contained in the NCSU Food Science Seafood Laboratory's Information Center. by Freda Ramey

UNC-SG-76-15 (no charge)

The dune book: how to plant grasses for dune stabilization

Discussion of the use of grass plantings for dune stabilization in North Carolina. Includes information on methods for planting American beachgrass, sea oats, bitter panicum and saltmeadow cordgrass.

by Johanna Seltz UNC-SG-76-16 (no charge)

To eel or not to eel: an economic analysis of a parttime eel fishing enterprise.

Discussion of the economic considerations of entering the eel fishery.

by Leon Abbas UNC-SG-77-02 (no charge)

Sea Grant? where we've come from, where we're headed

Summary of the UNC Sea Grant Program, including a brief description of past and current research efforts.

Karen Jurgensen UNC-SG-77-05 (no charge)

The citizen's guide to North Carolina's shifting inlets

Historical comparison through the use of aerial photographs of 22 active inlets along the North Carolina coast over a 25-year period.

by Simon Baker UNC-SG-77-08 (\$1.00 for all requests)

Out of state marketing channels for North Carolina fresh (iced) seafood during 1974

by John H. Summey, UNC-SG-76-11 (\$2.50) Mathematical modeling of circulation and hurricane surge in Pamlico Sound, North Carolina

by Michael Amein and Damodar S. Airan UNC-SG-76-12 (\$3.00)

A flow study of Drum Inlet, North Carolina by Paul R. Blankinship UNC-SG-76-13 (\$1.50)

Ten years of development of man-initiated coastal barrier dunes in North Carolina by W. Woodhouse, Jr., E. Seneca and S. Broome

UNC-SG-77-01 (no charge)

Dune stabilization with Panicum amarum along the North Carolina coast

by E. Seneca, W. Woodhouse, Jr. and S. Broome UNC-SG-77-03 (\$1.00)

An experimental investigation of some combined flow sediment transport phenomena by L. Bliven, N.E. Huang and G.L. Janowitz UNC-SG-77-04 (\$3.00)

Ocean and Coastal Law Teaching Materials

by Thomas Schoenbaum and others Vol. I, Ocean Law UNC-SG-77-09 (\$7.00 for all requests) Vol. II, Coastal Law UNC-SG-77-09 (\$5.50 for all requests)

Applications of a "radiation type" boundary condition to the wave-porous bed problem by Charles R. McClain, Norden E. Huang and Leonard J. Pietrafesa UNC-SG-77-10 (\$2.50)

Flow dynamics and sediment movement in Lockwoods Folly Inlet, North Carolina by J.L. Machemehl, M. Chambers and N. Bird UNC-SG-77-11 (\$3.00)

Proceedings of a seminar on wood in marine structures

edited by Michael Levi and Jerry Machemehl UNC-SG-77-12 (\$2.50)

The development of an improved method for the detection of enteric viruses in oysters by Robert Carrick and Mark Sobsey

State management of fisheries: the twin impacts of extended federal jurisdiction and Douglas vs. Seacoast Products, Inc.

by Thomas Schoenbaum and Patricia E. McDonald UNC-SG-77-15 (\$1.50)

An economic analysis of eel farming in North Carolina

by J.E. Easley and J.N. Freund UNC-SG-77-16 (\$1,00)

UNC-SG-77-13 (\$3.00)

Changes in law are not a guarantee of success

(Continued from p. 4)

He is also concerned about the impact of various state fisheries regulations that are directed toward purely nonaquacultural activities. At times the effect of these regulations is to outlaw aquaculture. For example, in North Carolina it is illegal to possess Bay scallops out of season. While scallops currently are not cultured within the state, the regulation, in its present form, would make scallop aquaculture illegal since cultured scallops must be handled out of season.

According to Schoenbaum, by simply providing exemptions for aquaculture within the regulations, many accidental constraints could be eliminated.

As part of his work with Sea Grant, Schoenbaum will be examining various model laws which may help North Carolina plan for the future growth and development of aquaculture. A movement is now afoot nationally to create a comprehensive federal aquaculture development plan. Bills to establish an aquaculture act have been introduced in both the U.S. Senate and House of Representatives. In California and Hawaii, state aquaculture development plans have already been initiated.

Schoenbaum admits that changes within the regulatory structure will not automatically guarantee aquaculture's success. "Law is obviously only one problem, and probably not the most serious one," he states. "But it's one that should be taken care of. It just doesn't make sense to have these artificial constraints, constraints that are there unthinkingly."

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Coming up:

Coastal Film Festival—Two evenings of informative films about the coastal zone and the changes that are occurring there. An entire evening is devoted to North Carolina's coast. The films are being presented at college and university campuses throughout the state, including Duke University, East Carolina University, UNC-Greensboro, UNC-Charlotte, UNC-Wilmington and Appalachian State University. Watch your local newspapers for the exact dates, times and locations of the presentations. Sponsored by UNC Sea Grant.

Bait Rigging Workshops—Learn special tips and techniques for preparing rigs for saltwater trolling with expert fisherman and bait rigger Doug Scott. Workshop schedule: April 8 in Raleigh, April 11 in Greenville, April 12 in Manteo, April 13 at Bogue Banks, April 14 in Jacksonville and April 15 in Wilmington. Watch listings in local newspapers for the exact time and location of each workshop. Sponsored by UNC Sea Grant.

Modernization in Fishing Industries and Communities: A Symposium on Social Issues—April 27-29, 1978, East Carolina University (ECU), Greenville, N.C. A look at the socio-economic impacts of various technological changes that have occurred in the fishing industry on the industry itself and on fishing communities. The symposium will also focus on some of the social impacts of changes in fishery zone legislation. Sponsored by the Department of Sociology and Anthropology and the Institute for Coastal and Marine Resources at ECU in cooperation with the Society for Applied Anthropology and UNC Sea Grant.



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March, 1978

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ORV use:

A question of resource management

It was a crowded, smoke-filled room.

At first glance one might have easily mistaken it for a town meeting in a scene from a John Huston western.

But the cast of characters was real and the setting spring, 1978, Nags Head, North Carolina. The topic of discussion: how should off-road recreational vehicles (ORVs) be managed within the boundaries of Cape Hatteras National Seashore? It was a question that was proving to be one of the most controversial issues the seashore had yet to face.

The crowd had come from miles away that stormy March evening to attend the fourth in a series of public workshops on the park service's planned revision of ORV use regulations. At the workshop, National Park Service representatives described the process by which a new management plan would be formulated. They asked the public to comment on a draft proposal they had prepared in January and make recommendations for improvement.

Reaction to the draft proposal was confusing and contradictory. Many rejected it outright as being incomplete and unacceptable. Others supported the park service's authority in knowing what was best for the seashore. But virtually everyone in the room

agreed that coming up with an equitable plan would not be easy. Ultimately it would require that a conscious decision be made as to which uses of the seashore had priority over others.

The National Park Service's decision to more closely regulate the use of off-road recreational vehicles within Cape Hatteras National Seashore and other park lands stems back to a 1972 executive order in which the park service was directed to "establish policies and provide for procedures that will ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of those lands, to promote the safety of all users of those lands and to minimize conflicts among the various users of those lands."

The executive order attempted to provide a framework from which a unified federal policy could be established. Specifically, it required that areas open to ORVs on public lands be located so as "to minimize damage to soil, watersheds, vegetation or other resources ... to minimize harassment of wildlife or significant disruption of wildlife habitat" and "to minimize conflicts between off-road vehicle

(See "National Park," page 2)

National Park Service struggles with the

(Continued from page 1)

use and other existing or proposed recreational uses of the same or neighboring public lands . . ."

In addition, the executive order required each land agency to monitor the effects of off-road vehicle use within its lands. If on the basis of these studies it was found that more stringent regulations were necessary, the agencies were given the authority to impose additional restrictions, provided the proper public input had been sought.

Nearly a year after the executive order was issued an initial management plan was adopted for the regulation of ORVs within Cape Hatteras National Seashore. The plan left approximately 49 miles of the 73½-mile-long seashore open to year-round ORV use, with another 21 miles open seasonally between Labor Day and Memorial Day. Drivers were required to use designated access ramps and could drive only along that section of the beach between the foot of the dunes and the ocean; dune driving was strictly prohibited.

In May, 1977 a second executive order was issued. This time the order directed agency heads to immediately close off areas to ORV use wherever it was determined that "the use of off-road vehicles will or is causing considerable adverse effects on the soil, vegetation, wildlife, wildlife habitats or cultural or historic resources of particular areas or trails of the public lands . . ."

"Those regulations shall be directed at protecting resource values, preserving public health, safety and welfare, and minimizing user conflicts."

-Executive Order 11644

By this time, according to Park Superintendent Bill Harris, it was becoming increasingly obvious to authorities within the Cape Hatteras seashore that the existing management plan for ORV use was not stringent enough to meet the requirements set forth in both executive orders. While the park service could not document all its findings, Harris noted that reports of pedestrian-vehicle conflicts were increasing each year. In addition, rapid shoreline erosion, especially in the Coquina Beach and Cape Hatteras Lighthouse area, was constricting the beaches and forcing ORV users to drive along the dunes during high tide. And so the park service began work on a new management plan.

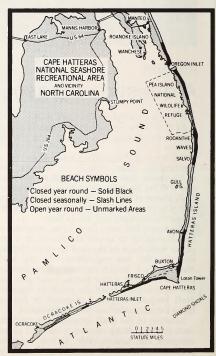
A press release was issued in July, 1977 asking for public comment on ORV use within the seashore. By autumn, the park had received 120 written responses, recommending everything from a complete ban on ORVs to unrestricted use.

Park officials then drafted a proposed management plan for the use of ORVs within the seashore.

The draft plan specified in segment-by-segment detail preferred management alternatives.

Citing problems with congestion, pedestrianvehicle conflict, dune erosion and wildlife disturbance, the park service proposal called for the yearround closure of 27½ miles of beach. Only 25 miles would be left open to year-round ORV use, with the remaining 11 miles open between October 1 and Apri-30. In addition, the park service proposal included recommendations for the construction of new parking facilities, reduced speed limits, annual vehicle permits and a corridor system for keeping vehicles off the dunes.

According to Harris, the draft plan was based on "the responses we [the park service] had received, the executive orders and our knowledge of what was happening to the seashore." He emphasized that it was in no way intended to serve as a final plan but as a point of reference around which the public could make its own recommendations.



The National Park Service's draft plan

RV question

No sooner had the ink dried on the pages of the proposal than the park service was hit with a barrage of criticism.

The most vocal opposition came from an organization known as the Outer Banks Preservation Association (OBPA), headed by Donn Mitchell of Nags Head. The OBPA has monitored federal actions on ORV use within the seashore since 1975, after successfully blocking the adoption of a proposal to close Pea Island National Wildlife Refuge to ORV use.

The alternative plan

Members of the OBPA were so dissatisfied with the park service's ORV management proposal that they drafted their own alternative plan. Under the OBPA plan, only 4½ miles of beach would be closed year-round to ORV use. Another 26 miles would be closed seasonally, from Memorial Day to Labor Day, and the remaining 43 miles would be left open year-round.

Among the OBPA's biggest criticisms of the park service's draft plan was the lack of evidence supporting the park's recommendations. "They have no justification for their plan," asserts Mitchell. "The only reason they give is pedestrian conflicts. Nowhere do they cite environmental or ecological damage."

"How many people do you see sunning themselves on the beach in November?"

OBPA members question why the park service has recommended year-round closure in many areas when the busiest season, the season when pedestrian conflict is most likely to occur, is only during the summer months. "How many people do you see sunning themselves on the beach in November?" asks one member rhetorically. "They aren't there. From Labor Day on there are no pedestrian conflicts," Mitchell argues.

The park service has also been severely criticized for it's failure to take into account the economic impact of increased ORV control under the draft plan. Park representatives admit that this was a serious oversight on their part. "Frankly," admits Pat Crossland, chief of interpretation at the seashore, "it never occurred to us." They have agreed, however, to conduct a complete economic analysis before any management plan is put into force.

Currently Cape Hatteras is the only national seashore which does not require a permit for ORV use. According to Mitchell, that, among other things, helps to make the Outer Banks one of the most attractive surf fishing spots in the East.



Cape Point—damage from ORVs driven over vegetated areas. (National Park Service photo)

Both Mitchell and other surf fishermen contend that increased restriction of ORV use will eliminate many of the trips made by fishermen to the Outer Banks, especially during the off-tourist season.

"It's simply not worth it for someone to drive all the way from New Jersey or Ohio to go surf fishing and to be restricted to Cape Point and the south side of Hatteras Village. They just won't come," Mitchell explains.

John Blizzard, manager of the Dare County Tourist Bureau, Inc., is concerned about what this loss might mean to the economy of the Outer Banks. "Surf fishermen do not bring in a major percent of the tourist dollar," Blizzard observes, "but they do bring in an amount that is sufficient enough to be an important element to the tourist trade."

The OBPA has gone so far as to estimate the amount of money brought into the area's economy by off-road vehicle users during 1977. Using National Park Service traffic surveys and Dare County Tourist Bureau estimates for average daily expenditures by recreational visitors, it claims that more than \$13 million was brought into the area by ORV users alone.

Many people view the figure skeptically, however. For one thing John Blizzard admits that the \$65 figure that the computation is based on is his "personal opinion" of what the typical surf fisherman might spend in a day. "I don't think that there are any realistic economic impact figures available."



Damage to dune vegetation from pedestrian walkovers (Dare County Tourist Bureau photo/R. Couch)

notes Blizzard. "Any figures that are used are speculative only."

Hank Boswell, executive vice president of the Outer Banks Chamber of Commerce, agrees that the figure is "not easily supported." He himself has serious doubts about the economic effect of increased ORV control. "I doubt that the [park service] proposal will have any great economic impact," states Boswell. "For one thing the visitors who use ORVs go primarily to three areas and these areas are going to be left open anyway under the National Park Service proposal."

Boswell also points out that increased control may actually have a positive economic effect by drawing those visitors to the seashore who now avoid it because of its relatively liberal ORV policy.

User groups react

Criticism has also come from various user groups. According to many surf fishermen, mobility is essential to the sport. They depend on four-wheel drive vehicles to follow the fish as they migrate up and down the shoreline, and to lug all their equipment across the dunes and onto the beaches. In addition, the fishermen argue that the best months for surf fishing are during the fall and spring—months when few pedestrians linger on the beaches.

As a result many sports fishermen see the park service's proposal to completely close portions of the beach as a direct threat to their use of the park, a use they claim they have a right to under the philosophy on which Cape Hatteras National Seashore was founded.

Even commercial fishermen, who use ORVs for beach seining operations, have raised eyebrows over the park service's draft plan. Although legislation creating Cape Hatteras National Seashore clearly protects the rights of local residents to earn a livelihood by fishing from the park's beaches, many commercial net fishermen have serious doubts about what will happen to their rights in the future as more and more restrictions are placed on ORV use in the park and along the entire coast.

"I just don't think the resource can support the effects of ORVs."

Harris emphasizes that the park service is not trying to eliminate any one user group from the park. "We aren't restricting fishing, we're restricting the use of ORVs." Harris explains that the park service is attempting to come up with a management plan that will allow for as much public access as possible, while maintaining both the environmental and aesthetic integrity of the seashore.

"You have to draw the line somewhere... No matter where you draw that line, you're going to have someone standing on the other side of it."

One possible solution, he believes, is to provide additional parking facilites. Under the park service's draft plan five new roadside parking sites with 240 spaces would be constructed. The parking sites, Harris contends, will make access by walking practical for both the surf fisherman and the sightseer.

Park officials admit that coming up with a completely equitable management plan may not be possible. "You have to draw the line somewhere," observes Crossland. "And no matter where you draw that line, you're going to have someone standing on the other side of it."

Just who will be left standing on that other side and when?

Harris does not deny that the day will come when ORVs are completely barred from the national seashore. "I don't think the resource can support the effects of ORVs," he asserts. "I remember when people would walk to the beach to fish, where ORVs were the exception rather than the rule... Today you have hundreds of vehicles on the beach."

When that day will be, Harris maintains, depends upon the kind of plan that is developed now. He concludes, "I think if we develop a good management plan now, we can push the time into the future when ORVs won't be allowed."

Deciding how, what, when, where

The control of off-road recreational vehicles is becoming a fact of life in the U.S. today. From the deserts of California, to the mountain regions of Colorado and the sandy beaches of Cape Cod, federal and state resource agencies are beginning to limit how, what, when and where ORVs can be used on public lands.



In making these decisions, resource managers are also beginning to realize how much more must be learned about the impacts of ORV use—both environmentally and socially. Mere subjective observation is no longer sufficient.

University of Massachusetts researchers studying the beaches on Cape Cod have established that vehicular traffic disturbs the drift line of accreting beaches where new dunes form. But how do these activities affect shorelines that are already narrowing from the actions of wind and wave, such as along much of coastal North Carolina? Are ORVs more damaging to dunes and dune vegetation than the trampling of human feet?

And what about the impact of beach traffic on the organisms which inhabit the intertidal zone? How do ORVs affect beach creatures such as the coquina clam, ghost crab and mole crab?

Biologists know that unless protected, seasonal nesting sites can be destroyed by vehicles driving through bird colonies. On most public lands effort is made to mark these areas and route traffic around them. But how does beach traffic affect bird life during the rest of the year?

There is also the human aspect of ORV use. The impact of seeing an ORV on a stretch of sandy beach affects each person differently. For some it may be an ugly reminder of man's technological encroachment on natural areas. To others, it's a thrilling sight. How do these reactions in turn affect the recreational experience? Are there ways to predict them? And, more importantly, are there ways to manage the resource so as to minimize user conflict?

Scientists Doug Wellman and Greg Buhyoft of Virginia Polytechnic Institute are currently studying the impacts and potentials for conflict among ORV and non-ORV users at Cape Hatteras National Seashore. Through a series of questionnaires randomly administered to seashore visitors during the summer and fall, they hope to find out such things as who are the major user groups of Cape Hatteras National Seashore, how these users define a good recreational experience and what are the kinds of conflicts that exist between users. In addition, the researchers will ask respondents to evaluate various management schemes for ORV use to see how they might affect the recreational experience.

Finding the answers to all these questions won't happen overnight. Many new questions will be raised as more and more information is uncovered. But ultimately these questions and their answers will shape the management of ORV use both at Cape Hatteras National Seashore and throughout the country.

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The process of turning a plan into law

There are numerous steps the park service's ORV management plan must go through before it becomes law.

Although park officials had originally hoped to have a new management policy in force this summer, it now appears that a policy will not be ready before late fall.

Currently the staff at the park's headquarters is reviewing and tabulating comments received during public workshops held throughout the state in February and March. Based on many of these recommendations, another draft management plan will be prepared. As with the previous plan, the draft will be open to public comment for a minimum of 30 days.

At the end of this period, regulations for the enforcement of the plan will be drafted by the park service and submitted to the *Federal Register* as a "proposed rulemaking." The proposed rules will again be open to public comment for another 30 days.

If, at any point in this process, major objections or recommendations for improvement are made, the park service may decide to revise the plan and hold additional public hearings.

If no major comments or objections are raised, the regulations will again be published in the *Federal Register*, this time as a final ruling. Thirty days later the regulations become effective.

Looking ahead:

Marine Recreation Exposition-Memorial Day weekend (May 27 and 28) at the Marine Resources Center on Roanoke Island next to the Manteo airport. A weekend-long exposition and demonstration of the various marine recreational activities available along the Outer Banks. Local businesses will be on hand to provide displays and information on such activities as camping, saltwater trolling, bait rigging, on-shore and off-shore boating, jet skijing, wind surfing, hang gliding and scuba diving. The Coast Guard will host demonstrations on boating and water safety. Inside the center, visitors will have a chance to learn techniques for cleaning, filleting and cooking fish. For shell collectors and beachcombers, there will be displays by local artists of crafts made from material found along the beach.

To cap off the activities on Saturday there will be a chicken and fish fry and an evening of bluegrass and country western music. The exposition is being jointly sponsored by the Outer Banks Chamber of Commerce, the Dare County Tourist Bureau, the Marine Resources Center and UNC Sea Grant. For more information on the exposition or details on how to reserve display space, contact Sea Grant marine advisory agent Dennis Regan at the Marine Resources Center, Manteo, N.C. 27954, telephone: (919)473-3937.

Sanitary practice in seafood production— May 22-25, 1978, Omni Hotel, Norfolk, Virginia. A workshop for seafood processors on current sanitary practices, techniques and standards. Sponsored by Virginia Sea Grant and the National Fisheries Institute, Inc.



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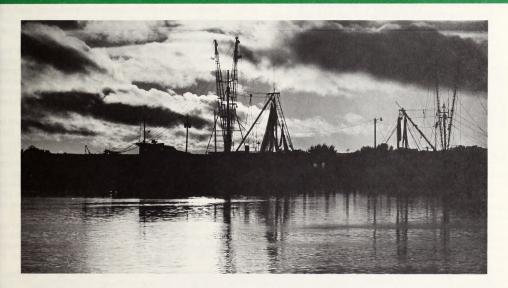


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SEA GRANT COLLEGE NEWSLETTER WAR 7 197

April, 1978

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Seafood Marketing

The winds of change grow stronger

Marketing. To most people it's an abstract, ill-defined word whose meaning is only important to the economist or businessman.

Yet, like it or not, marketing touches the lives of every one of us daily. Our economic system is based on a series of markets. And they are as vital to that system as the goods they serve to move.

In the seafood industry, marketing is the concern of all. From the dealer who sells ten thousand dollars worth of fish in a single phone call, to the small-time fisherman who works from sunup to sunset to fill his nets, everyone is interested in markets. And rightly so. In terms of marketing, seafood is one of the most complicated of commodities. Not only is it extremely perishable, but it is subject to highly individualized preferences. To make matters worse, supplies are never constant but bounce up and down according to the whims and seasons of nature.

In North Carolina, the channels and methods for marketing seafood have changed very little over the last several decades. Traditionally fishermen have sold their catches to local fish houses or "packers." From there, the fish are iced and packed whole in

(See "New laws," page 2)

New laws, rising consumer interest: the formula for change

(Continued from page 1)

boxes and sold either directly to retail markets within the state or to larger dealers who distribute the fish in more distant markets such as Baltimore, Philadelphia and New York.

Of course the product flow isn't always so simple or cleanly defined. Some of the fish are processed and then sold to wholesalers and retailers. Other supplies are frozen until market prices are more favorable. But for the most part, North Carolina's seafood industry has always focused on the sale of whole, fresh finfish and shellfish, with special emphasis on the more traditional, higher-yield species.

But there are indications that the industry may be

changing.

Signs of change

Though only a little more than a year old, the new 200-mile Fisheries Conservation Zone (FCZ) is already beginning to have an effect on U.S. exports of fishery products. Last year the U.S. exported more than 350 million pounds of fish valued at \$520.5 million. While we still import far more than we export—some \$2.6 billion worth in 1977—the export figure represents a record 35 per cent increase over 1976.

Obviously this increase cannot be solely attributed to the new fishery zone. Many other factors are involved, including the continued devaluation of the U.S. dollar abroad. But as more and more restrictions are placed on foreign fishing activities within the FCZ, it is only logical that other nations will begin to rely more heavily on U.S.-caught fish to meet demands for seafood. Thus the potential for a strong ex-

port market becomes more plausible. In addition, the 200-mile zone is beginning to open the way for the development of new markets and uses of relatively non-traditional species such as mullet, rock shrimp and squid.

There are other signs of change. Consumer interest in seafood, as reflected by per capita consumption, has shown a slow but steady rise over the last decade. Ten years ago per capita consumption of seafood in the U.S. averaged 11 pounds. By 1977 it rose to 12.8 pounds. Though the figure is dwarfed by beef and poultry consumption levels, it is a signal to many seafood marketing specialists that more and more consumers are developing a taste for seafood.

In North Carolina this changing climate has captured the attention of the entire fishing industry. Among organizations such as the state's Department of Commerce, the North Carolina Fisheries Association and UNC Sea Grant, there is growing concern over the impact these changes will have on the future of the North Carolina seafood industry.

Even within the legislative branch, the seafood industry has become the subject of great interest. During the 1977 session of the General Assembly, a special committee of the Legislative Research Commission was created to look into some of the problems of price instability in the commercial fishing industry. Though the committee has only begun its examination, it plans to make a full report to the 1979 General Assembly on the feasibility of legislation addressing this problem.

Elsewhere attention is being focused on the nurturing of new and broader markets for fresh seafood, both within the state and in the Midwest. Coupled with this has come increased interest in the in-



New markets will require changes in the industry as the appetite for seafood continues to grow.

dustry's expansion of processing capabilities so that it can move away from the "ice 'em down and ship

'em out" syndrome.

In order for the industry to grow-if it really wants to grow-it will have to update and expand and process the product in a more extensive form," maintains Fay McCotter, marketing and consumer specialist with the state Department of Commerce's Marine and Seafood Development Division.

Bob Barker, chief of the Marine and Seafood Development Division, agrees with McCotter that one of the biggest problems facing the North Carolina seafood industry is its lack of processing capability. He argues that this inability to process, freeze and store large quantities of fish has left the industry wide open to gluts, scarcities and dramatic price flucmations. In the end Barker believes both the fisherman and dealer lose out. "Neither one is making as much as they could from these products," he says.

The seafood park concept

One solution Barker and others envision is the development of seafood industrial parks at key locations along the coast. One such park-the Wanchese Harbor Development Project-is already becoming a reality. The 20-acre site in Dare County is expected to he completed by 1980. Among other things, the state-owned park will include facilities for major seafood processing, storage and distribution operations. Funding has also been approved for feasibility studies on similar projects in the Carteret County and Wilmington-Southport areas.

According to Barker, the seafood parks will be a valuable boost to the entire industry. Because their large-scale processing facilities will be able to accommodate tremendous volumes of fish, the parks will make it possible for fishermen to enlarge and modernin their fleets. As a spin off of this, Barker foresees the day of an expanded boat building industry within

Of course changes such as these will not take place omorrow. For one thing the North Carolina seafood adustry is made up of a fiercely independent lot who te often skeptical of large-scale, government-

ponsored development schemes. For example, not everyone agrees with the seafood

dustrial park concept. Some processors fear they lose substantial amounts of business to the irger, out-of-state processors who can afford to flocate in the parks. And there is some question as how much seafood dealers actually need to expand leir markets. Like many dealers, Milton Evans of ans Seafood Company in Washington is not parcularly interested in additional markets. "I've got l can handle," he emphasizes. "I don't need any

New markets or not, most observers agree that the orth Carolina seafood industry is in a stage of trantion. For many this will simply mean business as Bual. But for a growing number of fishermen, Processors and dealers, it will mean harvesting new pecies of fish and meeting new market demands.



Tapping the Midwest market

To most North Carolina coastal residents sitting down to a meal of fresh croaker or mullet is as natural as eating popcorn at the movies. But tell someone from St. Louis or Cincinnati that you're serving Spanish mackerel for dinner and you're liable to get a few stares.

These fish, like many of the less traditional fish caught off the South Atlantic coast, are virtually unknown in the central sections of the United States. As a result, markets for them have been primarily limited to a narrow region along the Southeastern coast. But if efforts to promote these species in the Midwest pan out, eating king mackerel in Memphis may one day be as acceptable as eating rainbow trout in Toledo.

For nearly two years now the Gulf and South Atlantic Fisheries Foundation, Inc. has been coordinating the activities of nine different organizations involved with the Midwest marketing program. The basic purpose of the project is to encourage the use of so-called underutilized fish through product development and marketing. If successful, it will not only expose consumers in these states to a source of high protein, low cost food but will provide South Atlantic fishermen with an additional, year-round market for their catch.

The initial concept of a Midwest marketing program began to take shape in 1975 when, in an effort to buoy up failing domestic shrimp prices, the National Marine Fisheries Service instituted its

Emergency Marketing Program, According to Roger Anderson, executive director of the Gulf and South Atlantic Fisheries Foundation, Inc., the Midwest was selected for several reasons. First its location was within reasonable reach of the Southeast. Plus it had the vital characteristics of being a relatively untapped market while having "good marketing potential."

The success of the Emergency Marketing Program eventually led to the current promotional program with its focus on new species development-in particular croaker, gray trout, king and Spanish

mackerel, mullet and rock shrimp.

Much of the money for the marketing effort comes from the Coastal Plains Regional Commission. Other organizations involved in the program include the National Marine Fisheries Service, Florida Department of Natural Resources, University of Georgia, South Carolina Wildlife and Marine Resources Department, Virginia Seafood Council, Virginia Polytechnic Institute and State University, North Carolina Fisheries Association and UNC Sea Grant.

During individual marketing tours, promotion participants from the various organizations visit target cities in the Midwest. This year the program has expanded to include 18 cities in Minnesota, Wisconsin, Iowa, Missouri, Illinois, Indiana, Michigan, Ohio, Tennessee and Kentucky. At each city, participants visit buyers representing area retail and institutional markets, providing samples and information on where supplies can be obtained.

"It's a little like being a traveling salesman," notes UNC Sea Grant participant Skipper Crow. "You spend the day going from buyer to buyer."

In addition to working with food brokers, participants place substantial emphasis on promoting the products among consumers. Information on the products, including recipe books, brochures and other educational materials, are distributed at demonstrations and exhibits. Marketing specialists also work closely with newspaper food editors and conduct live

and taped radio and TV programs.

So far marketing participants have been pleased with the results. Last year they received over one million dollars in complimentary advertising. And in January, Kroger, Inc., a large, Cincinnati-based grocery chain, instituted a fresh seafood market in about 200 of its stores, selling about 100,000 pounds of fish per week. "We think that alone has made it all worthwhile," observes Jim Ayers, program participant and fishery marketing specialist with the National Marine Fisheries Service.

There are, of course, problems that will have to be worked out before long-term markets in the Midwest can be established. Both the logistics and economics of transportation pose difficulties for dealers and retailers.

Currently it takes about seven to ten days to get fresh fish from the ocean to markets in the Midwest. With present packaging technology, that leaves the retailer only a few days to sell the fish before its shelf life expires—an added time constraint many retailers are unwilling to work around.

From the seafood dealer's perspective, the high cost of transportation is another drawback to marketing fish in the Midwest for the first time. "There's no way you can just go into a place and sell a truckload of fish," emphasizes Murray Nixon of Murray Nixon Fisheries, Inc. in Edenton. "You gotta do it gradually."

"The quantities we could ship at the beginning aren't enough to make it worthwhile," adds Tom Caroon of the Riverview Crab Company in Oriental. "The freight costs would eat us up."

According to Anderson, consumer acceptance is one of the biggest blocks to establishing markets in the Midwest. "Everything is new . . . the names are new, the fish are new, the recipes are new. It takes a long time to get consumer acceptance of anything new.'

Hand-in-hand with this is the problem of educating the people who handle the fish in the retail market. "The guy behind the meat counter has got to be adequately trained in handling the fish properly,' emphasizes Ayers, adding that it only takes one bad experience to turn a consumer off to fresh seafood altogether.

Despite these problems, there are indications that the Midwest marketing effort is paying off. Already buyers such as Kroger are beginning to worry about the availability of supplies on a year-round basis. In North Carolina, seafood dealers are studying the growth of these new markets with a watchful eye. They know that success in the Midwest could signal a change for the entire industry.

New markets closer to home

The search for new markets doesn't have to begin west of the Appalachians. Within North Carolina dealers are beginning to look more closely at markets in the central and western parts of the state—areas that have often been ignored in the past.

Not surprisingly increased public demand for seafood has had an impact in North Carolina. Today seafood restaurants and retail markets are popping up all over the state. Yet ironically many of the fish that are sold to these markets come from Virginia and South Carolina. "Our dealers have established routes up to Baltimore and New York markets," explains Fay McCotter of the state's Division of Marine and Seafood Development, "but they don't have an established drop off route in the western part of the state." As a result many dealers are missing out on profitable markets in their own back yards.

Back yard markets

That's one reason McCotter and others are trying to introduce dealers to markets in key distribution centers further inland. As part of this effort, the Division of Marine and Seafood Development in cooperation with the North Carolina Fisheries Association is setting up promotional exhibits of North Carolina seafood products. One such display was held in Statesville this spring where about 60 inland buyers met with seven coastal dealers. According to McCotter the exhibit was primarily intended to give retailers a chance to find out what kind of seafood products are available in North Carolina. After that, she notes, it's up to the dealers and buyers to make individual trade agreements.

Among dealers the concept of in-state marketing of fresh seafood has hit a far more responsive chord than many of the efforts in the Midwest. The biggest advantage appears to be distance. Most seafood dealers are interested in those markets they can reach with their own trucks. "I feel like we've got markets here in North Carolina," emphasizes Murray Nixon. "We could do a good job right here in North Carolina without shipping all the way West."

Yesr-round needs

But distance isn't the only critical element in expanding markets. According to McCotter, wholesale and retail markets, whether in the Midwest or the mountains of North Carolina, will require certain changes on the part of the seafood industry. "For one thing, it has to be a year-round thing; it can't quit. They have got to establish a reputable business that can offer the product year-round and not just three or six months a year." she stresses.



Today seafood restaurants and markets are popping up all over the state.

"It won't sell if it's not there on a week to week basis," adds Sea Grant marine advisory agent Skipper Crow. He emphasizes that retailers and wholesalers must be able to count on the supply because they know that if supplies are sporadic, sales will also be sporadic. "It would be like walking into your favorite grocery store and finding the beef counter empty for two weeks at a time . . . seafood would become a low priority item." Low priority items, adds Crow, are risky ventures in any business operation.

While many North Carolina processors already custom-cut their products, the newer markets will require that more and more of the industry process the fish according to consumer demands and specifications. The specifications will vary from market to market. For example, a restaurant or grocery chain might require that the fish be filleted and portion cut, while institutional markets, such as hospitals and schools, might prefer to dress and portion the products themselves.

"If I were to go into fish marketing today," observes Norm Angel, executive secretary of the North Carolina Fisheries Association, "I would beg, borrow and steal all the money I could to buy myself a wholly owned freezer and custom cut the fish for the consumer market . . . this is where the money is."

A festival of North Carolina folklife

Basket weaving, soap making, lye dripping, net making . . . Each is an integral part of North Carolina's cultural heritage. Yet for many of us these activities are something out of the past, found only in history books and legends.

The North Carolina Folklife Festival will bring these activities to life Saturday, July 1 through Tuesday, July 4 at Durham's historic West Point on the Eno River. It's all part of a four-day celebration of community and family folk traditions found throughout the state.

More than 300 crafts and trades people, musicians, storytellers, cooks and dancers are scheduled to participate in the festival. Each region of the state, including the mountains, piedmont and coast, will be represented through folklore, crafts, music and food. There will be boat building demonstrations from Harker's Island, blues guitar and piano music from Greensboro and corn meal grinding from Cherokee.

In addition to the regional folk exhibits and demonstrations, there will be a Crossroads section where both festival goers and participants will have a chance to talk about some of the traditional folkways in more detail and look at how these traditions have changed over time.

For children, a special Children's Area is being set up where the activities will include traditional games, songs, toys and crafts of the various regions.

The festival is sponsored by the North Carolina Department of Cultural Resources' Office of Folklife Programs. Admission is \$1 per day for those between ages 12 and 65, and 50 cents for ages 6 to 12. Senior citizens and preschoolers will be admitted free. All festival parking will be located at designated lots along the main routes to the festival. Shuttle bus service will be available from the parking lots to the festival.

For more information on the festival, contact the Office of Folklife Programs, North Carolina Department of Cultural Resources, Raleigh, North Carolina 27611. Telephone: (919) 733-4867.

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UNIVERSITY OF NORTH CAROLINA

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SEA GRANT COLLEGE NEWSLETTER

May, 1978

105 1911 Building NCSU, Raleigh, N.C. 27607 Tel: (919) 737-2454

Getting ready For LORAN-C

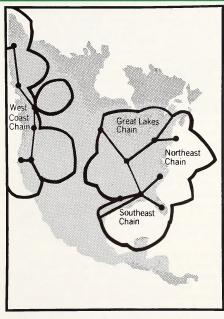
Here today, gone tomorrow. The saying doesn't apply to fashion design or pocket computers alone. It holds true for just about any product of technology. Take navigation. How many systems have been developed during your lifetime? Probably a lot more than you think. And while these changes have been for the better, they have created some problems for those caught in the transition.

That's one reason Sea Grant is working with the U.S. Coast Guard to help ease the burden of converting to the new LORAN-C system of navigation. Currently several systems of radionavigation are available along the United States. In addition to such private systems as Omega and Decca, the government sponsors LORAN-A and an older LORAN-C system. But by December 31, 1980, the new LORAN-C will be the only government-provided radionavigation system in the U.S. At that time all LORAN-A and older C services will be discontinued.

Converting to a new navigation system isn't as easy as pulling one plug and turning another one on. It means changes for everyone, and lots of them. From purchasing new equipment and navigational charts, to replotting and converting obstruction or "hang" locations, mariners throughout the U.S. will be affected by the switch over.

According to Lt. Commander David Carter, chief of the Coast Guard's LORAN-C Information Project, the decision to convert to a single system was made to avoid duplication and unnecessary expense. Navigational systems such as LORAN A and C, Omega and Decca were compared in detail on the basis of accuracy, efficiency of operation and cost to the mariner. And in 1974, the Department of Transportation selected LORAN-C as the government sponsored system of navigation.

Reaction to the selection was predictable. UNC Sea Grant Marine Advisory Agent Jim Bahen notes that many mariners, particularly commercial fishermen,



were already making the switch to C because of its greater accuracy and range. And while some objected to the costs associated with the conversion, most saw the switch to the more sophisticated system as inevitable.

Still, the actual transition will create some problems for mariners. Along the East Coast, existing "chains" or areas of LORAN-C coverage will be reconfigured once the new system is turned on this summer and next fall. That means marine operators already using LORAN-C will still have to convert their navigation charts and logbooks to the new system.

For LORAN-A owners, the conversion to C will require substantial investment in new equipment. (See "Easing," page 2)

Easing the transition

(Continued from page 1)

While several A models can be adapted for C use, the majority cannot. And there is some question as to the accuracy of converted models over long distances.

Currently Sea Grant and the Coast Guard are looking into ways to help make the transition as smooth as possible. Studies are being conducted at Oregon State University to see what kind of tax breaks, investment credits and capital improvement loans can be extended to mariners forced to buy new equipment as a result of the conversion. The Coast Guard is exploring the possibility of buying outmoded A systems from mariners who will not be able to use the equipment once the A chains are shut down.

In North Carolina, Jim Bahen is gathering information for a series of workshops he plans next year to help mariners learn about the new system, select the proper equipment and convert their navigation charts. To help with the conversion, the Coast Guard is developing a canned computer program which will enable marine operators to plug their old LORAN-A and C log coordinates into a desk-top calculator and automatically obtain the new C coordinates.

To further soften the impact of the switch over, most areas will be given a two-year transition period, during which both A and C will be available. Because of the way the transmission station network is set up, only the area including South Carolina, Georgia and northern Florida will be given one year, from 1979 to

1980, to make the conversion.

Currently the new LORAN-C coverage is available along the West Coast. Under the Coast Guard's implementation plan, the reconfigured Northeast chain will go into effect this summer, providing new C coverage from Canada south through North Carolina. Next fall a Southeast chain will be turned on and will cover the Gulf Coast and waters off southeastern Florida.

Once the LORAN-C chains are in operation, the Coast Guard will begin termination of LORAN-A transmissions. Carter emphasizes that the termination dates were carefully selected in an effort to minimize possible disruption of marine operations. Along the East and Gulf Coasts and the Caribbean, the shut off date is scheduled for December 31, 1980, coinciding with a relatively inactive season for boat use.

Although the A cutoff doesn't affect North Carolina for another two and a half years, Bahen is anxious for mariners to start thinking about the conversion now. He warns them against rushing out and buying a new Creceiver if they already own a reliable A system which can be used in the interim. But, he emphasizes, mariners should be studying the market now to find out what is available and at what prices.

Sea Grant and the Coast Guard have prepared several booklets to help explain LORAN and the conversion timetable. For more information, write: LORAN-C Information Project, U.S. Coast Guard (G-WAN/73), Washington, D.C. 20590. Or write UNC Sea Grant for a free copy of "What You Should Know About LORAN-C Receivers."

From stars To satellites

Navigation hasn't always been the precision science that it is today. In earlier eras it was more an art than a science as sailors used landmarks, stars and intuition to grope their way around the coast, from one port to the next. Rarely did a ship venture beyond the sight of land. When it did, it was only

through luck that it returned safely.

Celestial orientation has always played an important role in navigation. But through the centuries the overpowering desire to explore and chart the vast expanses of the oceans has given rise to more sophisticated tools of navigation. Though primitive by today's standards, poles and lines enabled ancient mariners to measure water depth. Later, the magnetic compass made it possible to measure direc-

tion day or night.

With the development of the sextant during the 17th century, the location of a ship could be even more precisely pihpointed. Eventually timepieces enabled navigators to plot longitudinal and latitudinal courses. Maps of the world, elaborately decorated with sea demons and monsters, were replaced with more detailed navigational charts, complete with degrees of longitude and latitude. Any gaps that existed were soon filled in as explorers continued to traverse the seas in search of adventure.

But it was not until the early 20th century that the science of navigation began to mushroom. Spawned by technology developed during World Wars I and II, radionavigation soon became a reality. Today radar and LORAN are as basic to ocean navigation as the

compass and sextant once were.

What next?
Satellite navigation is already commonplace aboard most military vessels. And according to many navigation experts, it is simply a matter of time before the technology of satellite navigation is transferred to civilian use. Of course the cost of the system will have to be substantially reduced. And an expanded network of satellites providing continuous signal readout will also have to be developed. But these are the kinds of problems that technology could conceivably overcome in a matter of years.

If satellite navigation is the system of the future, what, then, will happen to LORAN-C? According to David Carter with the U.S. Coast Guard's LORAN Information Project, there's still plenty of time to worry about that. "LORAN-C," he states, "won't

become obsolete before the year 2000."

Conversion from the consumer's Point of view

To most mariners deciding on a piece of navigational equipment is like choosing a car—it has to be dependable, easy to operate and maintain, and

it has to fit into a budget.

Finding something that meets all those criteria isn't so simple. Anybody who has ever shopped for an automobile knows that it takes a great deal of research and time to find the "perfect" selection. The same is true when it comes to purchasing LORAN equipment.

There are, however, a few tips to keep in mind if you are in the market for a new LORAN-C system.

Probably the biggest question about LORAN-C is when is the best time to buy equipment. Should you buy a receiver now, or wait and gamble on the chance

that prices will go down?

Unfortunately there aren't any pat answers. Currently prices for LORAN-C receivers range anywhere from a little over \$2,000 to about \$6,000. A year ago the least expensive models averaged between \$3,000 and \$3,500. A decade ago, even the cheapest LORAN-C receiver cost well over \$20,000.

Despite these downward trends, neither the Coast Guard nor LORAN manufacturers predict major

price decreases in the next few years.

According to Carter, prices may begin to drop again once inland uses of LORAN-C, for such things as police, fire, ambulance and highway work, begin to catch on. But he emphasizes that this is an area that is just beginning to be explored and it will be several years before it has any impact on industry pricing.

Like many LORAN dealers, Ted Scott of Sea Coast Communications, Inc. in Wilmington tells his customers to wait to buy LORAN-C units until they are certain about the kind of receiver they want and can afford it. "I wouldn't recommend that anyone go out and buy a C today unless their A unit breaks and the cost of getting it repaired is excessive."

But for someone buying a LORAN system for the first time, virtually every dealer agrees it's best to go ahead and purchase the C unit now, especially since the new C signal will be available along North

Carolina later this year.

To get the full benefit of the C system, the Coast Guard urges mariners to buy fully automatic receivers—receivers which will automatically pick up LORAN signals without the use of an oscilloscope and automatically track these signals through cycle matching.

Another important feature the Coast Guard recommends having on a unit is a blink alarm to alert operators to any errors in the signals being broadcast

from transmitting stations.

To filter out "noise" or interfering signals, a receiver should also have notch filters. Ideally it should display at least two time difference readouts either simultaneously or alternately so that the operator does not have to go through the acquisition



Bahen: "Shop carefully, know your needs"

process each time he wants a signal.

Finally, the receiver should be a multi-channel set, enabling the operator to tune in on several different chains without changing the receiver internally. For example, along North Carolina a multi-channel receiver would let the operator pick up any chain in the East Coast.

When it comes to actually buying a system, the most important thing to remember is to select the unit that is best suited to your needs. If you are a recreational boater and use your vessel only three or four weekends a year, it's probably a waste of money to spend \$6,000 on a LORAN system that also measures "course made good" (distance traveled), travel speed, longitude and latitude.

On the other hand, a commercial fisherman should purchase a durable piece of equipment—one that can withstand constant, day in and day out use in all

types of weather.

Always buy from a reputable dealer that offers complete warranty and installation service. Make sure you understand the operation of your equipment thoroughly before you use it. A mistake could cost a life.

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What is LORAN-C navigation?

LORAN is an acronym for long range navigation. And while it involves some relatively sophisticated electronics, the principle of LORAN is based on simple trigonometry. Simply stated, a line of position is obtained by measuring the difference in time it takes to receive signals transmitted at synchronized intervals from two onshore stations-a master and a secondary or "slave" station. Location is further pinpointed or fixed by obtaining a second line of position through the use of another slave station and the same master station. Plotted on a chart, the point where these two lines intersect is the position fix.

Currently two types of LORAN are operating in the United States. LORAN-A was originally developed during World War II for military purposes and was later adapted for civilian use. The more recent LORAN-C was developed during the 1950s, also for military purposes, and has been available for commercial use along portions of the East Coast including North Carolina since the early 1970s. Last year C coverage was extended to the West Coast (both

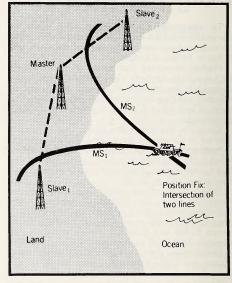
U.S. and Canada) and the Gulf of Alaska.

The primary differences between the two systems involve the frequency of signal transmission, the number of pulses each transmits and the way time differences between signals are measured. Because LORAN-C uses a much lower frequency (100 kHz) it has a much broader range of coverage with a greater

degree of accuracy.

The C system can pinpoint locations within a quarter of a mile. And it enables mariners to "repeat" or return to within 50 to 300 feet of these sites. By contrast, A is only accurate to within one to five miles. Even this falls off dramatically at night when the high frequency signals are often "drowned out" by sky waves.

The major users of LORAN are boat operators who need a reliable, accurate navigational system for pinpointing their location and the location of bottom obstructions and favorite fishing areas. Obviously



not all mariners need LORAN for navigation. Along inshore waters, radar and depth recorders are adequate. A recent study by Sea Grant researchers at Oregon State University indicates that only 30 percent of the commercial fishing vessels along the East Coast are equipped with LORAN, primarily LORAN-A. The same study found that recreational boaters are the largest single group of LORAN users.

But it appears that the number of users is growing. In light of the new 200-mile fishery zone and heightened interest in offshore oil and mineral exploration, it is likely that it will continue to grow.

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UNIVERSITY OF NORTH CAROLINA

SEA GRANT CO MEWSLETTIER

June, 1978

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North Carolina's bountiful estuaries

There are nearly 2.3 million acres of estuaries, tidal study on North Carolina seaweeds. But after several discussions with Japanese researchers at various marshes, bays and sounds along North Carolina's

coast. If that sounds like a lot, it is. North Carolina ranks third, behind only Alaska and Louisiana, in estuarine waters found along its coast. These waters form the backbone of the coastal environment.

Through a delicate balance of water, plants and nutrients, estuaries provide nursery grounds for many of the state's most valuable commercial finfish and shellfish. But in recent years these areas have come under increasing strain. Fishing pressures are growing more intense, while environmental pressures from industrial and agricultural runoff are threatening many existing catches.

At Sea Grant, scientists are studying the effects of these pressures on the many important resources which come from estuaries. As part of their research, they are taking a new look at some relatively unknown estuarine plant and animal species to see what role these resources might play in the future as a source of food for man.

Six years ago when Don Kapraun first noticed nori growing in some of the tidal creeks near his home in Wilmington, he didn't think much about it. A biologist at the University of North Carolina at Wilmington (UNC-W), he was busy at the time with a scientific meetings, he soon realized that the plant could become a valuable food crop.

Nori, also called Porphyra after its Latin name, is a red alga. Its high protein and vitamin content make it a nutritious ingredient in such Oriental foods as sushi and egg drop soup. In Japan and Korea, the mild seafood flavor of dried nori is about as popular a seasoning as garlic and sage are in the United States. Today nori is the single most valuable marine resource in Japan, drawing in an estimated \$100 million a year. More than 68,000 fishermen are in some way involved with the culture and harvest of nori.

In North Carolina, nori grows on oyster reefs in the shallow waters of the state's tidal creeks. Because the plant actually attaches itself to oyster shells, Kapraun believes it could be collected along with the oysters and thereby provide fishermen with an additional source of income.

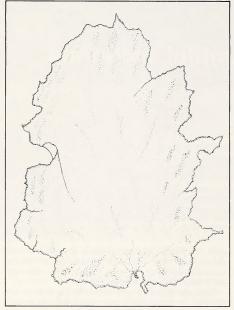
With the help of Sea Grant funds, Kapraun is taking a closer look at the nori which grows in North Carolina to see whether commercial harvest is feasible. His research has already turned up some rather unusual findings.

(See "North Carolina," page 2)

North Carolina nori receives high marks

(Continued from page 1)

During its lifetime, nori has essentially two life phases. In warmer months, it grows as tiny microscopic filaments known as conchoceli. Sometimes these filamentous blobs appear as dark stains on oyster shells. With the arrival of cooler weather, dur-



Nori blade (drawing by D. Kapraun)

ing late October and November in North Carolina, the combination of shorter days, lower light intensity and cold temperatures triggers a change in the algae and the conchoceli begin to develop into ribbon or leaf-like blades. Within a month the blades are ready to harvest

Yet the species of nori in North Carolina has an interesting twist to it. Unlike the nori found in the Orient, the plant can reproduce and form both phases from either the blade or conchocelis.

"The Porphyra doesn't have any sex," explains Kapraun. The finding is important for many reasons. Aside from the purely scientific aspect, it may mean that nori can be heavily harvested without any affect on population since new blades or new conchoceli are formed from microscopic spores left in the water.

Because the blades mature in about four weeks, it also may be possible to harvest three crops per year—

one in January, another in February and a third in March. This is an important advantage since it takes about 10 pounds of the fresh nori to manufacture one dry pound.

Nutritionally, North Carolina's nori may be on the same par as the Japanese Grade A variety. With the technical assistance of Dr. Carl Lundeen, a biochemist at UNC-W and biology student Doug Luster, Kapraun has been able to analyze the protein, lipid and carbohydrate content of the plant. Although further tests are needed, nori rated better than 37 percent protein per dry gram in initial studies.

According to Kapraun, one of the biggest advantages of the nori found in North Carolina is its distinctive appearance. No other leafy marine alga in North Carolina has a red-purple color.

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Yet people do eat the Rangia. And some North Carolina seafood dealers, always on the lookout for new products, have hopes of reviving the Rangia market. In the late 1890s Rangia was marketed in Texas as the "Texas little neck." During the 1960s, a North Carolina seafood dealer sold the clam to markets in New York City for use in a clam cocktail.

But suddenly things began to turn sour for the Rangia in North Carolina. A shipment of fresh, shucked Rangia clams bound for markets in New York City failed to pass an inspection by New York health authorities. The reason: the clams contained a higher than acceptable level of bacteria. The entire shipment was seized and \$10,000 worth of Rangia clams was destroyed.

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In the laboratory, each sample was analyzed for bacterial content. And after a year of study, the researchers determined that the Rangia clams had a naturally high level of bacteria. More importantly, they found that samples taken from waters open to shellfishing did not contain any pathogenic (disease causing) bacteria.

If the bacteria in the clams were not pathogenic, why did New York health authorities reject the shipment of North Carolina Rangia?

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According to Kane, a similar situation exists with the Rangia. "We have demonstrated that the high standard plate count is not at all indicative that these organisms [the Rangia] are accumulating higher levels of disease organisms than any other seafood," observes Kane. "There isn't a shred of evidence which indicates that they are more dangerous than any other shellfish," he adds.

While the Kane and Jeffreys study indicates that the Rangia may be safe to market from a bacteriological standpoint, there are still many questions that need to be answered before the clam can be given a completely clean bill of health.

Because the Rangia grows best in waters that are only slightly brackish, such as those found in the upper reaches of estuaries, it is exposed to more concentrated levels of waste runoff than are many other estuarine organisms. From a public health standpoint that's an important distinction. As filter feeders the clams ingest water and suspended sediments which pass around them. If toxic substances, such as pesticides and heavy metals, are present in the water, (See 'Taste,' page 4)

Taste, shelf life still pose problems

(Continued from page 3)

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"We need to know more about the clam's population in terms of recruitment and replacement," asserts Kane. "I would hate to get all tooled up for something that may be only a flash in the pan."

Although it was once thought that the Rangia was restricted to Gulf Coast waters prior to the 1950s, fossil sediments from prehistoric times reveal that the clam did occur along North Carolina thousands of years ago. Why did the clam disappear for centuries and then suddenly reappear? Could it happen again?

The answers to these and other questions will require further research and careful study. But Kane



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UNIVERSITY OF NORTH CAROLINA

SEA GRANT CO MEWSLETTER

June, 1978

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105 1911 Building NCSU, Raleigh, N.C. 27650 Tel: (919) 737-2454

North Carolina's bountiful estuaries

There are nearly 2.3 million acres of estuaries, tidal marshes, bays and sounds along North Carolina's

coast. If that sounds like a lot, it is. North Carolina ranks third, behind only Alaska and Louisiana, in estuarine waters found along its coast. These waters form the backbone of the coastal environment.

Through a delicate balance of water, plants and nutrients, estuaries provide nursery grounds for many of the state's most valuable commercial finfish and shellfish. But in recent years these areas have come under increasing strain. Fishing pressures are growing more intense, while environmental pressures from industrial and agricultural runoff are threatening many existing catches.

At Sea Grant, scientists are studying the effects of these pressures on the many important resources which come from estuaries. As part of their research, they are taking a new look at some relatively unknown estuarine plant and animal species to see what role these resources might play in the future as a source of food for man.

Six years ago when Don Kapraun first noticed nori growing in some of the tidal creeks near his home in Wilmington, he didn't think much about it. A biologist at the University of North Carolina at Wilmington (UNC-W), he was busy at the time with a

study on North Carolina seaweeds. But after several discussions with Japanese researchers at various scientific meetings, he soon realized that the plant could become a valuable food crop.

Nori, also called Porphyra after its Latin name, is a red alga. Its high protein and vitamin content make it a nutritious ingredient in such Oriental foods as sushi and egg drop soup. In Japan and Korea, the mild seafood flavor of dried nori is about as popular a seasoning as garlic and sage are in the United States. Today nori is the single most valuable marine resource in Japan, drawing in an estimated \$100 million a year. More than 68,000 fishermen are in some way involved with the culture and harvest of nori.

In North Carolina, nori grows on oyster reefs in the shallow waters of the state's tidal creeks. Because the plant actually attaches itself to oyster shells, Kapraun believes it could be collected along with the oysters and thereby provide fishermen with an additional source of income.

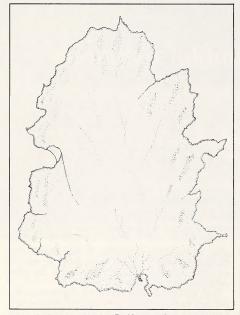
With the help of Sea Grant funds, Kapraun is taking a closer look at the nori which grows in North Carolina to see whether commercial harvest is feasible. His research has already turned up some rather unusual findings.

(See "North Carolina," page 2)

North Carolina nori receives high marks

(Continued from page 1)

During its lifetime, nori has essentially two life phases. In warmer months, it grows as tiny microscopic filaments known as conchoceli. Sometimes these filamentous blobs appear as dark stains on oyster shells. With the arrival of cooler weather, dur-



Nori blade (drawing by D. Kapraun)

ing late October and November in North Carolina, the combination of shorter days, lower light intensity and cold temperatures triggers a change in the algae and the conchoceli begin to develop into ribbon or leaf-like blades. Within a month the blades are ready to harvest

Yet the species of nori in North Carolina has an interesting twist to it. Unlike the nori found in the Orient, the plant can reproduce and form both phases from either the blade or conchocelis.

"The Porphyra doesn't have any sex," explains Kapraun. The finding is important for many reasons. Aside from the purely scientific aspect, it may mean that nori can be heavily harvested without any affect on population since new blades or new conchoceli are formed from microscopic spores left in the water.

Because the blades mature in about four weeks, it also may be possible to harvest three crops per year—

one in January, another in February and a third in March. This is an important advantage since it takes about 10 pounds of the fresh nori to manufacture one dry pound.

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UNIVERSITY OF NORTH CAROLINA

SEA GRANT COLLE NEWSLETTER MAR

August, 1978

105 1911 Building NCSU, Raleigh, N.C. 27650 Tel; (919) 737-2454

Coastal archaeology

A look at human history

David Phelps has spent countless hours during the last 10 years sifting through garbage dumps and graveyards in coastal North Carolina.

The fruits of his labors line tables and shelves in the archaeology lab at East Carolina University: bone fragments, snake vertebrae, human skulls and pottery sherds. Each scrap is marked with a series of tiny identifying numbers which make it possible for Phelps to tell exactly where—to the square meter of earth-the piece was found.

To the uninitiated these little bits of the past are baffling. But for Phelps each is a key to understanding the early cultures of coastal North Carolina.

Thanks to Phelps and ten other archaeologists now working in North Carolina, the once fragmented picture of prehistoric Indian life in this state is slowly being completed. But Phelps' concerns run deeper than setting the academic records straight. He prefers to say that he is "attempting to organize the lessons of human history." He's convinced that what he digs up in coastal North Carolina is relevant to contemporary residents of the area.

Phelps believes that the link between current residents of coastal North Carolina and the Indians who lived there 10,000 years ago is the area's wealth of natural resources. It's the one constant in a world that has changed radically. And he thinks it's crucial for contemporary man to understand how the Indians used these resources and adapted their lifestyles to the land.

The ancient garbage pits that Phelps excavates often tell at least part of that story. A list of their contents reads like an Indian menu: mollusk, possum, terrapin, fish, bear and deer remains.

"While many people look at archaeology as a sort of esoteric field, we like to think that eventually with the understanding of how man has used particular



(See "Understanding," page 2)

Understanding the roots of modern culture

(Continued from page 1)

environments and how he's adapted to both climate and natural changes, we can learn some lessons about

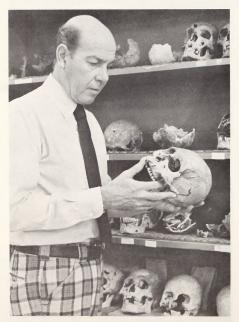
our own future," says Phelps.

Much of Phelps' work points to a startling similarity in the ways that different coastal people have adapted to the land. Take Collington Island, for instance. Excavations on the site have turned up evidence that 2,000 years ago Algonkian Indians established fishing camps there during the season of the year when food was scarce elsewhere. The early colonists built temporary fishing villages there. And today it is largely a resort area, catering to seasonal tourists. There are a few fishing villages on the island, located in the same protected spots where the early colonists lived. But for the most part, few have found the island suitable for permanent occupation.

But there are major exceptions to the Collington Island case. The arrival of modern technology meant a radical break in man's relationship to the land and its resources. The most noticeable changes have occurred on the mainland since about 1850 and on the

Outer Banks since about 1930.

The Outer Banks, Phelps points out, have existed in their present state for only 3,000 years. Until the 1930s all the settlers there chose the same sites for locating their homes and villages. They built in the



Phelps: organizing the lessons of human history

relative shelter of scrub oak forests on the sound side of the islands—never on the ocean side. This settlement pattern remained virtually unchanged until paved highways came to the banks in the 1930s. With roads running right up to the dunes, oceanfront construction seemed less formidable. Since then, man has consistently built on valuable oceanfront property, often destroying the only natural protection from the storms and erosion—the dunes and maritime forests.

In addition to endangering his physical safety modern man has begun to seriously pollute his environment. Phelps calls this trend "technological override of the ecosystem" and he thinks it's extremely dangerous. "The real emergency is that human technological systems have become so efficient that most people in a highly complex culture (such as the United States today) have no contact with or knowledge of the natural environment. They can't see the fact that the destruction of food producing environments, pollution of stream systems or surplus human populations will ultimately affect the culture's subsistence base," he says.

In the final analysis any culture, no matter how advanced, is dependent upon its ability to produce food.

During the centuries before modern technology, Phelps points out, the bond between man and culture was more obvious. The Algonkian Indians who settled most of coastal North Carolina were especially adapted to that area. They lived in villages located on high areas or bottom lands beside streams and rivers. Unlike many of the settlements in inland areas, these were permanent. At that time inland Indians had to move seasonally in order to stay close to game and other food supplies. But the coastal people had ready access to fish and shellfish all year.

Tom Loftfield, an archaeologist teaching at the University of North Carolina at Wilmington, notes that the natural environment in turn affected the Indian's culture. With a stable food supply, the coastal Indians had less incentive to change. Agriculture, for instance, is thought to have come to the coastal area several hundred years after it was established inland.

And because of their relative isolation from other Indian groups, the coastal Indians tended to retain traditional culture longer. English records indicate that Indians during John White's time (late 1500s) retained the old shaman religion which was based on the worship of gods of the hunt even though they were a fully agricultural society. At that time the culture had a formal priesthood and a group of shamans, an unlikely combination.

Even today on the Outer Banks tradition seems to have a strong hold. Ocracoke residents still celebrate Old Christmas in the tradition of the early English colonists. More importantly, notes Phelps, they observe the Old Buck ceremony at Christmas, which has its origins in the 30,000 year old European tradi-

tion of bull worship.





Digging—patience is the prime ingredient

David Phelps has one word for what it takes to put together an archaeological dig. Patience. Digging up a quarter-acre site with masons' pointing trowels, paint brushes and grapefruit knives is no picnic.

Whether the work is done on the shores of the Euphrates or in coastal North Carolina, the archaeologist's concerns are the same: to find artifacts and to find them just as they were left by the culture he's interested in.

"The primary object is to find things in their context. If you were using a bulldozer, you'd never get that context. There's just no mechanical way to do this," says Phelps.

Consequently, one dig can take anywhere from a month to twenty years to complete. But the archaeologist's job begins long before the actual digging gets underway. Selecting a potential site requires extensive knowledge of the environment and the people he's studying... plus a little bit of luck. A ground search of the chosen area and a couple of test digs will usually reveal whether there is actually anything to be found there. If so, the real nitty-gritty work beggins

The crew first digs a set of sample pits to get an idea of the distribution of artifacts in the area. Once that's done, there are two ways to go with the major excavation. If the goal is to reclaim as many artifacts as possible, the archaeologist will plan to dig up a large area. But he may be interested in only one aspect of the culture, such as the use of food resources. In that case, the field crew will zero in on specific sections of the site, such as the garbage dump (euphemistically known as the midden) and food preparation areas.

The site is then divided into a grid of two meter squares. Laborers set to work, digging one square at a time. Within each square there may be several vertical layers corresponding to the different time periods the area was used. Each layer may be from six inches to several feet deep. Workers peel back one layer at a time, photographing and drawing to scale all artifacts before they are removed.

The squares link together to form a trench, which can be enlarged at any section if the archaeologist finds something particularly interesting.

The actual digging is a painstaking process, usually done with tiny hand tools such as grapefruit knives so that nothing will be damaged. Nearly everything, including fish scales, can be used to tell something about a culture. After being numbered, materials are taken to a lab for analysis.

No archaeologist would attempt a dig alone. According to Phelps, the ultimate in an excavation crew includes a director, ceramics expert, photographer, draftsman, metallurgical expert, ethno-botanist, archaeological zoologist, geologist, assistant directors, a number of junior archaeologists and lab and field workers. Phelps, like most of his colleagues, operates on a more down to earth scale. During the summers, he usually works with a skeleton crew of a draftsman, lab supervisor, two assistants, two crew chiefs and six laborers.

Just in case you're tempted to begin excavating in your own back yard, Phelps adds another caution. No archaeological work should ever be done without the proper know-how and facilities. "If the work is to be worth anything, it must go to a laboratory to be catalogued and preserved," he says.

And that's another lengthy process. The analysis of one month's work in the field takes an average of three months. Patience. Patience.

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Of burial grounds, back yard digs

Mark Ramsing spent most of the last year poking around New Hanover County, occasionally digging in people's back yards. Thanks to Ramsing, Jean and Ernest Puskas have discovered that they may have an Indian burial ground on their property.

And the Puskases aren't alone. Under a pilot grant from the Comprehensive Employment and Training Act (CETA), Ramsing headed a survey of the county designed to locate potential sites for archaeological digs. By the time it was all over this summer, two teams of workers combing the county had discovered 530 historic and prehistoric sites. Their most significant find was a burial ground which Ramsing believes belonged to the Cape Fear Indians.

The data from the New Hanover County survey will be fed into a new computer mapping system which has been set up by the state Archaeological Branch in Raleigh. Along with information from all other known sites in North Carolina, it will help archaeologists determine what types of terrain were most often inhabited by prehistoric and historic groups.

Coastal archaeology takes hold

The CETA survey is one sign that archaeology is coming into its own in coastal North Carolina. Until David Phelps began teaching anthropology at ECU, most of the archaeological research in the state was centered in the piedmont and mountains.

That was seven years and many excavations ago. Since then Phelps and his students have made some important archaeological finds, mostly in the northern coastal area. They've conducted surveys of major estuarine systems and paid special attention to ossuaries or mass burial sites. In fact, they've uncovered four ossuaries, each containing about 35 skeletons.

Phelps and his students have excavated several sites which had been continuously occupied for about

10,000 years. In general, they've gotten a good picture of the lives of Algonkian Indians who originally inhabited most of the northern coastal region.

Archaeological work in the southeastern section of the state got underway about three years ago when Tom Loftfield joined the faculty of UNC at Wilmington. Like Phelps, Loftfield offers a summer excavation school for his students. The school has been located at a site on Core Sound near Swansboro, where Loftfield has found evidence of prehistoric Indian pole houses. Though little is known about the Indians of southeastern North Carolina, Phelps believes that they were part of a loose political organization of Souian language groups.

Uncovering a matriarch

Though Phelps has worked mostly on Algonkian Indian sites, his prime training site is a Tuscarora Village at Jordan's Landing near Williamston. One find of special interest to Phelps is a 10,000-year-old skeleton he fondly refers to as "the matriarch." She was uncovered several summers ago, lying in a single pit with a strand of beads around her neck. Her relatively advanced age and the fact that she was buried alone indicate to Phelps that she was held in high esteem in that matrilineal community. Two similar skeletons were found there this summer.

But not all archaeological digs are conceived in university laboratories. Government regulations now require that archaeological surveys be done prior to construction of new federal highways, parks, wastewater facilities and subdivisions. That has meant a lot of "running before the bulldozer" for coastal archaeologists. Phelps emphasizes that construction has rarely been stopped because of archaeological finds. Except in rare cases, all artifacts are lifted from the spot and taken to a lab. Then the site is usually closed up again. Phelps is now working on a similar excavation on property that will eventually be affected by the Wanchese Harbor development.



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UNIVERSITY OF NORTH CAROLINA

SEA GRANT COLLEGE NEWSLETTER MAR 7 1979

September, 1978

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The well-built beach house has:

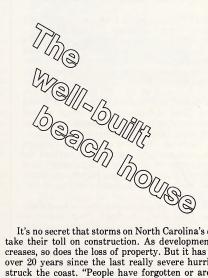
-tiedowns connecting roof to walls to foundation;

-sufficient elevation to be above most storm waters;

-pilings of sufficient depth to withstand considerable beach erosion;

-well-braced pilings;

—and, no permanent walls enclosing pilings.



It's no secret that storms on North Carolina's coast take their toll on construction. As development increases, so does the loss of property. But it has been over 20 years since the last really severe hurricane struck the coast. "People have forgotten or are not aware of the destructive nature of hurricanes, and the quality of construction has continued to deteriorate," says Dr. Jerry L. Machemehl, of the North Carolina State University School of Engineering.

ing.
"Very few people would be prepared for a major hurricane," says Machemehl. "Most of our structures would not stand a very catastrophic storm based on how they're presently built. We do feel though that by properly anchoring the structures, by putting the piles into a sufficient depth, by choosing the right size

(See "Houses," page two)

Houses could stand 100 years

(Continued from page one)

members, by using the right type of wall section that we could harden these structures and decrease their

vulnerability to the storms."

With Sea Grant funding, Machemehl is developing minimum foundation, roof and framework standards that will enable coastal builders to construct more storm resistant houses. Eventually Machemehl plans to compile his findings into a model building code which he will present to state officials.

Machemehl believes that a properly designed house, using the guidelines listed on page one, could stand for 100 years. Today most coastal structures do well to last 30 to 40 years, he says. Some even estimate average life at only 25 years. Machemehl and

The dangers

North Carolina's coast feels the brunt of both frequent Northeasters and hurricanes.

Considerable beach erosion, winds and waters damage property during Northeasters. The Ash Wednesday storm, the most severe in recent memory, caused more erosion on the coast from Hatteras northward than any previously known storm. It opened an inlet 200 feet wide on Hatteras Island and destroyed acres of protected dunes. Miles of highways were either washed out or buried in sand. Beach homes by the hundreds were destroyed or damaged.

A hurricane the force of Hazel is likely to strike once every 100 years. An example of the destructiveness of coastal hurricanes is a National Weather Service report on Hazel, which made landfall in South Carolina on Oct.

15, 1954:

"Wind-driven tides devastated the immediate ocean front from the South Carolina line to Cape Lookout. All traces of civilization on that portion of the immediate waterfront between the state line and Cape Fear were practically annihilated. Grass-covered dune some 10 to 20 feet high along and behind which beach houses had been built in a continuous line five miles long simply disappeared, dunes, houses and all. The paved roadway along which the houses were built was partially washed away, partially buried beneath several feet of sand. . . .

"Of the 357 buildings which existed on Long Beach, 352 were totally destroyed and the other five damaged. Similar conditions prevail on Holden Beach, Ocean Isle, Robinson Beach and Colonial Beach. In most cases it is impossible to tell where the buildings stood. Where grassy dunes stood, there is now only flat, white, sandy

beach."

others believe that the keys to safety are getting the house above storm waters, presenting minimum resistance to those waters, and making the house one solid unit to resist destructive forces.

Coastal storms subject buildings to basically four types of damage. The most destructive force generated by a hurricane is usually the storm surge. The surge is a mound of water pushed up ahead of a hurricane advancing inland from the water. According to Machemehl, the surge causes the greatest property damage and loss of life. Nine out of 10 people who die during a hurricane are drowned by the storm surge.

Another major destructive force is flooding both from heightened ocean level and from the torrential rains that accompany hurricanes. Taken together, storm surge and flooding cause structural and foun-

dation failures, says Machemehl.

Then come the winds. Minor damage such as broken windows can be expected with winds of about 50 miles per hour. Major structural damage begins to occur when winds exceed 100 miles per hour. If a roof goes, as is often the case in high winds, then walls are also subject to collapse and the entire structure is jeopardized.

Finally, erosion results from a combination of surge, winds and flooding. Beach structures are often undermined during severe beach erosion, weakening foundations and other structural supports, according

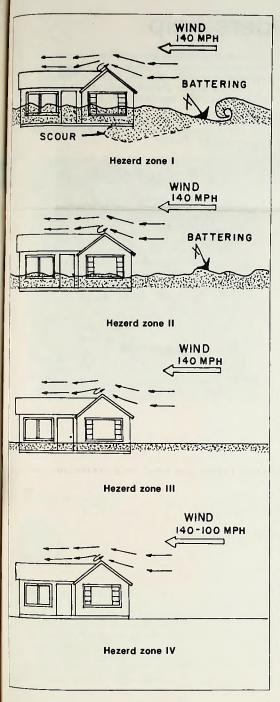
to Machemehl.

The most severe damage to buildings in the coastal zone results from foundation failures, Machemehl reports. Next in severity is roof failures, normally caused by inadequate ties between the structure and the roof. The least severe damage, but largest in terms of monetary loss, involves failure of siding, broken windows, loss of porches and garages.

A major shortcoming of present construction, Machemehl contends, is that pilings are not placed deeply enough. The North Carolina Residential Building Code appendix on coastal construction specifies that pilings be placed at a depth of eight feet below the natural grade of the lot. But Machemehl says that often isn't deep enough. Erosion can undermine pilings, leaving the house vulnerable to wind and waves.

In addition, Machemehl believes more attention should be paid to the joints and connectors which make a beach house one unit. Though the state code Appendix D requires both in coastal construction, he says more precise specifications are needed. When lumber is connected properly with pieces of steel rather than with nails, the structure can withstand more force.

According to Machemehl, the most dangerous structures are prefabricated buildings and trailers, structures placed directly on the ground rather than on pilings (they float), and buildings which are not tied down with metal connectors.



If the surge doesn't get you, the winds will

Builders could make more informed decisions about construction standards if they knew what forces they were up against in a given area, says Dr. Jerry L. Machemehl of North Carolina State University.

With Sea Grant funding, Machemehl is mapping coastal hazard zones for five different classes of storms. When completed, the maps will show the geographical potential for flooding, beach erosion, winds, storm surge, rainfall, inlet migration and overwash. The storm classifications range from Northeasters (winds less than 74 miles per hour) to catastrophic hurricanes (winds over 150 miles per hour).

The maps will delineate four hazard zones in coastal North Carolina.

Hazard Zone I—which is the most seaward, including beach, berm and the first line of cottages—will be subject to the full impact of hurricane force winds, waves and flooding from storm surge. Buildings in this zone will be susceptible to battering by debris and may be floated off their foundations by storm surge. In addition, they may be undermined by severe beach erosion.

Hazard Zone II also will be subject to a hurricane's full impact; however, buildings will not be affected by beach erosion.

Hazard Zone III will be subject to hurricane force winds and flooding from rainfall, while structures in Hazard Zone IV will be subject to hurricane force winds only.

Machemehl's preliminary findings indicate that in North Carolina erosion of up to 30 feet, rainfall up to 20 inches or more, and winds of 130 to 140 miles per hour are not uncommon for a 100 year storm.

When his maps are completed, Machemehl hopes prospective builders will use them when deciding what storm forces to build for. Special precautions in coastal construction make building costs about 5 percent higher than in inland areas, Machemehl estimates.



The yetch club, Wrightsville Beech, efter Hurricene Hezel

Definitions of 'safe' beach house vary

Shortly after Hurricane Hazel "tore up jack on the coast" in 1954, Kern Church sat down and wrote Appendix D of the North Carolina Residential Building Code. "We had to do something," says Church who is Deputy Commissioner of Insurance, Engineering and Building Codes Division for the state.

The building code and its appendix are one of three major controls on the quality and location of construction in North Carolina beach communities. The other two programs are the Coastal Area Management Act and federal flood insurance.

Appendix D deals specifically with coastal construction and is primarily concerned with wind storm resistance. Houses within 150 feet of the mean high water line are required to have pilings sunk eight feet below the natural grade of the lot (a figure Church says "I took off the top of my head"). Tiedowns must be used to secure roofs, walls and foundations. Though the Residential Building Code is used statewide, Appendix D must be adopted locally. And local building inspectors enforce the regulations.

The Coastal Area Management Act (CAMA) delineates ocean hazard areas including beaches, frontal dunes, excessive erosion areas and inlet lands. Development is kept behind the frontal dune. Setback guidelines, based on a 25-year storm surge, prohibit permanent structures in areas ranging from 61 to 156 feet landward from the toe of the frontal dune. Similarly, development within 75 feet of the mean high water line on the sound side requires a permit. In effect, CAMA first influences the location of construction, protecting natural features. Secondly, it calls for enforcement of state building codes, in-

cluding Appendix D, in the areas of environmental concern. Local building inspectors are responsible for permit letting for sites smaller than 20 acres or 60,000 square feet.

Federal flood insurance is intended to provide a tool for regulation of development in flood prone areas and low cost flood insurance protection to individuals living in these areas. The coverage is written by private insurers and is federally backed through the Federal Insurance Administration (FIA).

Communities are required to assess flood potentials and adopt necessary guidelines to protect structures from 100-year flood levels. Elevations required in coastal North Carolina range up to 14 feet above mean sea level.

Individually or taken together, the three programs are not without problems. Administrators of the programs acknowledge that they do not mesh, and that they allow some construction to "fall through the cracks" with little control. Some programs are criticized for not being stringent enough. Each of the programs is administered in a given geographic area. "None of these areas really correspond. You may have one, two or three permits in a given area," says Mike Black, Chief of Technical Services for the Office of Coastal Management.

Rob Moul, coastal management consultant for the CAMA staff, cites another—and often raised—concern. On occasion, he says, it seems federal flood insurance actually encourages hazardous development.

(See "Rethinking," page five)

'Rethinking' codes, insurance, CAMA

(Continued from page four)

Moul cites an example of a builder who sought permits to build on land adjacent to an inlet; in addition, the site had little or no dune formation—land considered by the state to be highly unstable. Though the CAMA staff advised the builder of the danger, Moul says, he shrugged off their warnings saying that he had his federal flood insurance.

According to Moul the incident is not all that unusual. He has seen similar cases in which federal insurance has had the effect of taking the risk out of what the state considers hazardous development.

In response to the criticism, Bill Harris of the FIA, says "We don't know what the effect would be if we weren't there. I guess the question is would they (builders) be there anyway, regardless. You can always have specific cases in which someone may feel safer by virtue of having the insurance, but I doubt that has been the final, underlying, deciding factor.

"The flood insurance program," Harris continues, "makes (builders) aware of the consequences and requires a building that will at least preclude damage during certain types of storms.

"But greater storms will occur. We don't want people to get a false sense of security with this 100-year flood and they shouldn't get a false sense of security because they've built to a particular elevation."

The state's Residential Building Code and its Appendix D also draw criticism. Dr. Jerry L. Machemehl of North Carolina State University cites problems with inadequate piling depth, lack of detail on tiedowns, and inadequate consideration of the effects of wave action.

Church says "We're open to any suggestion. We just don't have the proper information." The code is scheduled to be rewritten in the next year, notes Church. He hopes the new code will have more information, in a simpler, illustrated format, on the hows and whys of coastal construction. He adds that some communities have already changed the piling depth to 12 feet.

Moul points out that fewer than three fourths of the towns in the coastal area have adopted Appendix D. Further, he says, the building code is not generally enforced in counties. But he adds, state guidelines call for all counties to enforce building codes by 1984.

Another major sticking point on the code is enforcement. Critics and administrators alike agree that the code needs better enforcement. "That's a problem," says Church. "There never was anything on how qualified (the inspectors) had to be. It's a hit or miss proposition." And in some cases, he adds, "where a fellow was doing a good job, he got run off." Another factor which has sometimes kept more qualified people out of the job, says Church, is low pay.

Church explains the situation should change some-



Erosion can undermine ocean-front buildings

what in the next year. On July 1, 1979, new regulations on qualifications for inspectors will go into effect.

"We may still have some who may not be as qualified as they ought to be," remarks Church. But he adds the problem should eventually be corrected with the new regulations.

The outlook for the federal flood insurance program and CAMA is changing too. Efforts are underway to better coordinate the programs and simplify the permit process, according to Mike Black.

The CAMA staff, says Black, is "rethinking" the ocean hazard areas category and better coordination with FIA is one of the goals. Harris also says his staff is working to mesh the various regulations and simplify programs, particularly the state sand dune ordinance and the building code.

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Engineer offers builders help

During its useful life, a coastal house can be expected to experience severe weather conditions including continuing erosion, Northeasters and hurricanes. Houses could be made more storm resistant if buyers and builders knew more about the vagaries of coastal weather, says Spencer Rogers, Sea Grant's coastal engineering advisory specialist.

Rogers works out of the Fort Fisher Marine Resources Center advising coastal buyers and builders on sound engineering practices. He emphasizes, for example, the need for substantial pilings to elevate structures above the 100-year storm level as well as the use of secure tiedowns. Part of Rogers' job is to work with individuals who need help in designing homes that are as well engineered as possible.

Another of nature's nasty habits that takes people by surprise is estuarine erosion. Such erosion is a fact of life; but there are ways to slow its effects. Rogers' other major area of concern is advising people on how to deal with estuarine erosion using such devices as bulkheads, revetments and groin fields.

He is particularly concerned with the bulkhead problems he has seen recently. A well designed bulkhead should have a lifetime of 20 to 30 years. Instead, bulkheads are failing in a year to five years. Though the costs for a well designed bulkhead are high, in the long run, Rogers says, it is probably cheaper to do it right the first time rather than replace bulkheads every few years.

Rogers, a native of Virginia's Eastern Shore, came to North Carolina this year from Florida where he worked with the Bureau of Beaches and Shores in the Department of Natural Resources administering the coastal construction setback line. He holds a Bachelors degree in engineering from the University of Virginia and a Master's from the University of Florida Coastal and Oceanographic Engineering Laboratory.

For more information on bulkheads, erosion control and other coastal engineering questions, contact Rogers at (919) 458-5780.

Related publications

The following related publications are available from UNC Sea Grant, Box 5001, Raleigh, N.C. 27650. Please enclose a check made out to UNC Sea Grant where appropriate.

Information for buyers and owners of coastal property in North Carolina, details on permits and the coastal environment, no charge.

Relative estuarine shoreline erosion potential in North Carolina, a method for determining erosion intensity on specific shorelines, no charge.

The citizen's guide to North Carolina's shifting inlets, photos and illustrations of 22 migrating inlets, UNC-SG-77-08, \$1.00.

Know your mud, sand and water, a practical guide to coastal development, information on the coastal environment and its management, UNC-SG-76-01, \$1.25.



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UNIVERSITY OF NORTH CAROLINA



SEA GRANT COLLEGE NEWSLETTER

October, 1978

105 1911 Building NCSU, Raleigh, N.C. 27650 Tel: (919) 737-2454

Of ducks, geese And guns

On a crisp fall morning Watson Stuart and his dog Red go down to the water's edge behind Stuart's home. Stuart readies the boat, loads in his guns. Then he drives a few miles by car to Caroland Farms where he picks up two passengers who have drawn his name from a hat.

Back at the boat, they set off from Bell's Island. By seven they are anchored, the boat is encircled with a floating blind of juniper and pine, and Stuart has put out 40 decoys.

The object of their efforts is the abundance of ducks and geese which pass through North Carolina every year on their way south along the Atlantic flyway. The flyway is one of several in the country.

North Carolina has better shooting than any other state on the Atlantic flyway, according to William E. Hollan, past state chairman of the hunters' organization Ducks Unlimited. There is more opportunity for success, he says, and the setting is unique. Unlike most other states, waterfowl hunting here is done over large stretches of open water, primarily sounds.

While waterfowl are hunted all along the state's coast, Currituck County is considered a prime hunting spot. Hunters come from all over the country. Ralph Barco, who owns a hunting lodge in the county, says his clientele comes from areas as far flung as Connecticut, Illinois, Texas and Florida.

Hunters shoot from private blinds which often are owned by guides. Stuart has been a guide in Currituck County for four years. He and the hunters will stay in the blind most of the day trying to "limit out." At day's end, Stuart returns the hunters to their lodging. For guide service, room and board, each hunter pays \$70 (based on double occupancy). The guide gets half of that and must provide boat, blind and decoys. The hunter provides his own license, guns and ammunition.

The actual hunting hasn't changed much since Blanton Saunders, Stuart's neighbor down the road at Poplar Branch, began hunting and guiding in the



Stuart and Red in hunting boat

1920s. Except, he says, there are fewer birds and more hunters now. Saunders remembers flocks of birds that looked "like a squall, they just darkened the sky."

While the birds are no longer plentiful enough to darken the sky, they still rely heavily on the Currituck area. It was, according to Tom Massengale of the North Carolina Nature Conservancy, "the most important unprotected area on the Atlantic flyway." Since 15 to 17 percent of the ducks on the Atlantic flyway winter there, the Conservancy, a private conservation group, acquired land on the Currituck Outer Banks to provide a home for the birds. The Conservancy now owns Monkey and Swan Islands, a total of 5,000 acres of marsh and 1,500 acres of high ground.



Saunders with decoys, some homemade

Also, the National Audubon Society recently was given the 3,600-acre Pine Island in Currituck County to manage as a waterfowl area. Massengale says he hopes coordinated management will be worked out for all three areas and perhaps some of the lands owned by the remaining hunting clubs in Currituck County. The three islands comprise most of the major areas of waterfowl marsh on the Currituck Outer Banks.

Hunting: good, bad news

Hunters in North Carolina killed 30 percent more ducks last year than in 1976. That's more ducks than were killed in any other southeastern state.

One reason the figure went up is that more scaup, a species of duck, stopped off in North Carolina than usual. But Wildlife Resources Commission officials are the first to admit that they really aren't sure why more scaup stopped off on their way south or why the total kill went up so dramatically.

The situation is indicative of the illusive nature of waterfowl hunting and management in North Carolina. Firm figures are hard to come by and the factors which influence bird populations and habits are complex. Bird populations seem to be holding their own, but there are a number of issues which concern hunters, managers and conservationists.

Official records show 276,049 ducks were killed here last year. But one unofficial estimate places the figure at twice that once illegal hunting, exceeding bag limits, time restrictions and shooting over bait, is

taken into consideration. Since ducks and geese are hunted in sounds, rivers and ponds, enforcement of regulations in these remote areas can be difficult. And, hunters say more people are hunting.

Birds generally summer in the North and winter in the South. Breeding grounds in the North have been degraded so fewer birds are making the southbound migration than did 50 years ago. And waterfowl habitats in North Carolina are shrinking because of increasing development, though water pollution is not the problem it once was.

The well-being of ducks and geese which pass through the state is thus subject to a complex set of factors. Some informed observers predict the end of waterfowl hunting as it is known today—based on biology, not anti-hunting sentiment. More often though, observers say things are basically fine while cautioning that bird populations and habitats must continue to be protected.

In coastal North Carolina waterfowl are hunted on private gamelands, on public gamelands and in open sounds. From about Oregon Inlet northward, most hunting is done with the assistance of a guide who provides the blind. Currituck Sound, in the northeastern corner of the state, is probably the most important waterfowl hunting area in North Carolina. In the southern part of the state, hunting is carried out without guides.

The federal government maintains approximately 110,000 acres of refuges and 35,000 acres of adjacent lands in North Carolina so that passing birds will have a place to rest and eat. In some cases, hunting is allowed on the refuges. But generally hunting is prohibited within 500 feet of the refuges.

The state manages about 3,520 acres of public gamelands to provide habitat for ducks and geese. Hunting is allowed in the gamelands and some blinds

are provided.

Additional refuges where hunting is limited are provided for waterfowl by the North Carolina Nature Conservancy and the Audubon Society. Some private clubs also maintain gamelands though the clubs are not as prevalent as they once were.

Management

The various species of waterfowl are managed jointly by the United States Fish and Wildlife Service and the North Carolina Wildlife Resources Commission. Each year the federal agency assesses individual waterfowl breeding populations to establish a framework for seasons and numbers of kill.

Within that framework the state agency sets season dates—November 22 through November 25 and December 6 through January 20 this year in the eastern part of the state—and bag limits. The bag limit this year allows a hunter to take on a given day: five mergansers; five ducks; 15 coots; and seven sea ducks. There are some bonuses and restrictions. For example, redheads and canvasbacks may not be killed

this year.

Fish and Wildlife Service statistics show that of 10 major species of ducks, some breeding populations were down and others were up last year. While the canvasback—on which the season is closed this year—experienced a whopping 40 percent decline, many other species increased: gadwall up 31 percent; wigeon, 42 percent; green-winged teal, 53 percent; shoveler, 34 percent; pintail, 14 percent; redhead, 21 percent. Declines of 7, 3 and 5 percent were reported for mallards, blue-winged teal and scaup, respectively.

Grady Barnes, assistant chief for field operations, Division of Game of the Wildlife Resources Commission, says these figures indicate that waterfowl are in basically good shape. The real danger, he says, is the destruction of breeding and feeding grounds. "When you start to destroy that, you're running into trouble." Waterfowl populations will never be as great as they were in the 1920s and 1930s, Barnes says, due to the destruction of breeding habitats farther north. In Canada, for example, where many species breed, prairie lands routinely have been converted to farm land.

To recreate breeding grounds, Ducks Unlimited (DU), a national organization of hunters, has spent millions of dollars to lease and manage land for sanctuaries. Last year alone DU collected \$13 million. North Carolina chapters raised over \$500,000. (North Carolina traditionally has ranked among DU's top fund raisers on a per capita basis.)

Adaptability

With 20 different species of duck alone—each with different habits, populations and habitats—changes in waterfowl habitats can have unexpected effects. For example, canvasback, the species which is in the most trouble now, seems to be a victim of environmental degradation.

Jack Donnelly, state waterfowl biologist for the Wildlife Resources Commission, explains that due to the elimination of grasses on which the bird once fed, the canvasback has been changed from a plant eater to an animal eater. The bird also requires very particular breeding conditions. "Nobody's really sure what's happened to them," Donnelly says. But they're 'not very adaptable and any bird that's not adaptable in these days is in trouble."



Hunter and dog in the marsh

As development—draining wetlands, mining, large-scale land use changes, for example—eats away at natural habitats, private as well as public refuges become increasingly important. But the refuges can have their problems, too. David Lee of the state's Museum of Natural History notes that disease can be a threat to waterfowl which are concentrated on the refuges, but he adds that, unlike the Midwest, North Carolina has not yet had serious problems.

"If we had it to do over again, we'd try to do it a different way," says Donnelly. In effect, the refuges have been too successful and gregarious birds will not disperse. "We've put too many birds in small areas,"

Donnelly concludes.

Another issue is whether it is unfair to bunch birds up in refuges so hunters know where to find them. Opinions differ on how well the birds handle the threat of hunters near refuges. Lee says that the birds learn to fly high over the borders and spiral down once they are in safe territory.

Of course, clustering birds also affects hunters. Since the birds are no longer spread over such wide areas of natural habitat, hunters have smaller areas in which to shoot. William E. Hollan, past state chairman of DU, says that with increasing numbers of hunters and decreasing hunting area, waterfowl hunting isn't as easy as it used to be.

'The bad guys'

While Lee says management seems to be working for the most part, he says the "bad guys" of hunting—the unsportsman-like hunters—"shoot everything that flies." Because of violations, he says, the real kill is "many fold more than what's reported." A North Carolina hunting guide says the most common violations are shooting over bait or after hours, exceeding the limit and shooting species on which the season is closed.

Enforcement is carried out by both federal and state officials. The problem is that so many of the violations are almost impossible to detect unless an officer is staked out in the marsh watching individual hunters. With fewer than 100 state and federal enforcement agents in North Carolina's coastal area such monitoring would be difficult since there were about 26,000 duck hunters in the state last year.

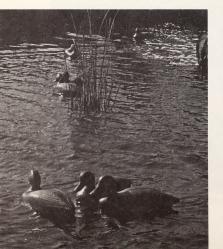
Though 425 waterfowl violations were prosecuted last year, Donald E. Curtis, chief of enforcement for the Wildlife Resources Commission, acknowledges that not everyone is caught. But he says that given the personnel at hand enforcement is good.

Conservation

Hollan says there is growing sentiment for conservation. For example, he says sentiment at last year's Wildlife Resources Commission public hearings on hunting restrictions was decidedly in favor of returning to stricter bag limits rather than continuing the more generous point system. Under the point system, individual species are assigned a point value and limits are based on total points rather than total number killed.

Though he says it's too late for some states farther north to do much to replace habitat, Otto Florschutz, state waterfowl biologist for the Fish and Wildlife Service, says North Carolina can still defend and improve waterfowl habitat. Furthermore, he says the courts are more consistently backing up enforcement. So, despite waterfowl population fluctuations, he thinks waterfowl hunting will continue to be enjoyed in North Carolina "with a little bit of far-sightedness."

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UNIVERSITY OF NORTH CAROLINA

SEA GRANT COLLEGE NEWSLETTER

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November, 1978

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Meeting Head Om

When L. C. Barrow retired and moved to the tiny town of Waterlily in 1969, he thought he'd found his paradise. Nestled on the shores of the Intracoastal Waterway, his house overlooked the shimmering waters of Currituck Sound. From his dock, Barrow could launch his boat and spend his days fishing for bass and eels or just watching the water.

Although the exotic aquatic plant had already begun to spread in the sound, Barrow had no idea that in a few years' time huge, thick blankets of Eurasian watermilfoil would nearly force him to leave Waterlily.





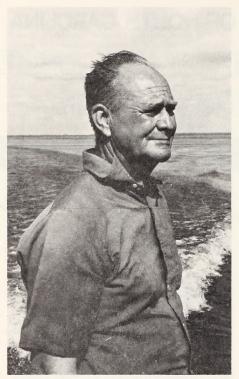
By 1975 the milfoil had spread across more than 60,000 acres of the sound. According to Barrow it had become so dense that "you couldn't see the sound. Our shoreline for 100 yards out was a solid mat of dead, decaying, stinking, rotting milfoil," says Barrow. "It looked like an open cesspool."

In some areas mats of milfoil stood out like sand bars. Paths continually had to be cut through the mats so that boats could move across the sound without getting their propellers strangled by the weed.

But Barrow's worries about milfoil went far beyond the smelly mats that would stack up in front of his home. "I was afraid the sound was actually going to ruin itself. It was becoming so stagnant that I

was afraid it was dying," he explained.

Barrow wasn't alone in his concern about the milfoil and what it might be doing to the sound. Other Currituck residents had questions about the milfoil. Unable to find answers, they turned to Sea Grant for help.



Barrow: "I was afraid it was dying"

Eurasian watermilfoil, known simply as milfoil, has mysteriously appeared and then disappeared in lakes and waterways throughout parts of the United States since the late 1800s when it was accidentally brought into the country from Europe. Researchers believe the plant was transported to Currituck Sound from Chesapeake Bay in the early 1960s.

Little is known about the plant's effect on wildlife, water quality or other aquatic plants. That's a major reason UNC Sea Grant decided to support a comprehensive, two-year study of the milfoil in Currituck Sound.

"Our basic purpose," explains UNC Sea Grant Director B.J. Copeland, "was to find out what role milfoil played in Currituck Sound both ecologically and economically and whether or not control was possible. If it wasn't, then we had to find ways we could learn to live with milfoil."

The first step was to draw together all the existing information on milfoil. In 1976 a conference was held at the Marine Resources Center on Roanoke Island. Currituck residents, government officials and milfoil

experts discussed the problems and potentials of milfoil. Recommendations were made as to what Sea Grant's study should focus on in the following years.

Since then researchers have found:

—Mowing is too costly to be practical to control milfoil in the entire sound, but regular mowing can be effective to maintain channels;

—The milfoil has less of an economic impact than some people expected;

-Milfoil does not seem to be harmful to fish populations;

—The suitability of milfoil as a breeding habitat for biting flies varies from year to year according to weather conditions.

Ironically as the researchers put the finishing touches on the study, it appears that milfoil may be taking care of itself. Milfoil growth is down dramatically throughout much of the sound. For the first time in several years the waters in front of Barrow's house are virtually clear of milfoil.

No one is really sure why the milfoil is disappearing. One of the researchers, Graham Davis of East Carolina University, thinks that severe northeasters and heavy rains last year may have made the sound too turbid for the plant to grow.

"Milfoil is more sensitive than other plants to these conditions," observes Davis. But whether the plant will die out is a question no one can answer. "Milfoil could come back stronger than ever in two or three years. Or it may not come back for another 10 to 15 years. Or it may not come back at all," says Davis. "At this stage, it's really anybody's guess." According to Davis milfoil growth may ultimately depend on wind and rain conditions next spring.

Mowing, harvesting?

One of the biggest questions about milfoil was whether growth could be effectively and economically controlled. Earlier studies by the Department of Natural and Economic Resources indicated that it would be too costly to use large amounts of herbicides, such as 2,4-D, to control the weed throughout the sound. A similar conclusion was drawn from another study by Sea Grant researcher Ernie Knowles on the use of saltwater to control milfoil.

Underwater mowing was yet another option. The technique had been used in Wisconsin, Ontario and other areas. Sea Grant researcher Graham Davis was anxious to see what effect repeated mowing would have on the regrowth of the milfoil in Currituck Sound.

During the two-year study, Davis and a team of graduate researchers looked at the effects of mowing



Davis: "It's really anybody's quess"

on milfoil growth. Carefully selected plots were mowed at regular intervals during the peak growth season. Control plots were left unmowed for comparison.

Even before all the data had been analyzed it was obvious that mowing was not totally effective. Davis found that unless an area could be cut three or four times in a growing season, mowing actually encouraged regrowth.

There were other problems with mowing. According to Davis unless the mowed milfoil could be harvested, the cuttings could wash ashore in huge floating mats or sprout new plants.

Mowing was also time consuming. And that makes it expensive as a control technique. With routine mowing, Davis found that only eight to 10 acres could be covered in a day. In dense patches the mower had to creep along at one mile per hour. Davis estimated that 50 to 100 machines working every day all summer long would be needed to control milfoil

throughout the sound. Even the smallest mowers cost around \$1,500. Add to that the price of labor, fuel and maintenance and the cost is substantial.

Davis believes that mowing is practical only on a small scale to maintain localized weed-free "canals" for swimming, boating or other special uses. But he thinks the whole picture could be changed if a commercial use of milfoil were developed.

Jerry Hardesty, Currituck County extension agent, agrees with Davis. According to Hardesty the county doesn't have the money to support milfoil control on even a limited basis. But by finding a commercial use for the plant, he thinks that the county could "turn a liability into an asset we can all live with."

Davis also looked at the nutrient content of the milfoil on a dry weight basis to see how it compared with fertilizers and livestock feeds. The results look promising, but he cautions that the high water content of the plant (nearly 90 percent) may make it too costly to process into a dried form.

What about fish?

No one can say that B.R. Vance doesn't know Currituck Sound. For 30 years he has fished nearly every acre of it. "He knows the sound better than the back of his hand," his wife proudly claims.

First as a fishing guide, then as a vacationer and now as a resident, Vance has probably caught more largemouth bass out of Currituck Sound than most people have ever dreamed of. And he's kept extensive records of his experiences.

According to Vance the beds of milfoil act "just like a game preserve." As a result he says he's been able to catch more bass and larger bass since the exotic plant came to Currituck Sound. "Milfoil gives them protection. It's a cool place in the summer and it gives them a hiding place." He adds, "When you fulfill those requirements you've got bass here."

But not all fishermen agree with Vance. Some claim the weed has hurt bass and other fish populations by using up oxygen and other important elements and minerals. Others argue that the bass fishing only "appears" to be better because the milfoil concentrates the fish into open or edge areas where they fall easy prey to the fisherman's lure. Still others contend that, more fish or not, the sound is just plain too hard to fish with all the choking weeds.

For nearly two years now Mel Huish and Howard Kerby of the Cooperative Fisheries Unit at North Carolina State University have been trying to determine if the milfoil has had an effect on fish populations in Currituck Sound. Much of their study has been based on a comparison of earlier information collected by state and federal biologists in the late 1950s and early 60s before milfoil had reached the sound.



Sampling activities in Currituck Sound

Through a monthly sampling program, the scientists have looked at the number, size, age and types of fish caught plus such environmental conditions as water temperature and salinity. Their studies have primarily focused on the largemouth bass, because, says graduate researcher Jim Borawa, "it's the fish the people want to hear about the most." But they also have collected information on a variety of other fish including carp, catfish, golden shiner, and white and yellow perch.

Although the researchers are still analyzing data gathered and comparing them with "pre-milfoil" studies, their results indicate that the milfoil hasn't had a harmful effect on fish populations.

In some cases changes in populations have varied according to species. For example, the researchers found that compared to earlier studies the number of largemouth bass has grown since the milfoil's arrival. But because the total population of fish has also increased, the proportion of bass to the total population has actually gone down.

The question remains, is the milfoil responsible for the population changes? According to the researchers there isn't a clear-cut answer. Milfoil has been the biggest change in the sound since fish studies were started in 1958. But variations in other environmental conditions also may have contributed to population changes.

Vance is convinced that milfoil is an asset to the fish. Bass fishing, he claims, hasn't been as good since the milfoil started disappearing from many parts of the sound last year.

Economics of milfoil

Robert Doughety has lived and worked in the Currituck Sound area since 1958. But it was not until milfoil had become a household word that he decided to open the Currituck Bait Barn.

"I personally would not have built this building or bought this property had the milfoil not been here," says Doughety.

According to Doughety it was the presence of milfoil that boosted the sound's sports fishing industry to the point where bait and tackle shops like his could survive. "Milfoil, as far as I am concerned, is the greatest thing that has happened to the sports fishing in this part of the country," he asserts. "Anyone who tells me this milfoil has hurt them, well they've got to prove it to me," he says, adding, "I think that there are more people making a living off the sound than ever before."

Not everyone agrees with Doughety. Some residents argue that business and property values have been hurt by the milfoil. Others claim the plant hasn't had any effect.

The question of milfoil's economic impact is an intriguing one. It's a question that Sea Grant economist Leon Abbas felt had to be answered before the milfoil story could be fully understood. "We wanted to get some idea as to the extent that Currituck Sound, as a resource, influenced the economy of Currituck County," Abbas explains.

Through a series of surveys, Abbas and graduate researcher Dennis McCornac were able to identify the various businesses that depended directly on the sound and how much money they generated. The researchers found that sound-related activities in 1976 contributed nearly \$5 million to the economy.

Next, the researchers asked business operators, property owners and visitors to the sound how they felt about the milfoil and how it affected them. More

than 55 percent of those interviewed were negative about the milfoil. Another 37 percent were positive, while 12 percent had no opinion. The majority, 70 percent, felt that something should be done about the milfoil, ranging from total elimination to only limited control.

Of the 44 businesses surveyed, 41 percent of the owners felt that the milfoil had no particular effect on their businesses. Twenty percent said the milfoil had a negative effect and 39 percent felt it had a positive effect.

Abbas warns that responses are never black or white in an attitude survey. But the surveys do quantify the importance of Currituck Sound to the area's economy. And they say something about attitudes toward milfoil. "It's data that suggests that 'the milfoil problem' isn't as serious as some people think it is," says Abbas. "There just isn't the ground swell of 'let's-get-rid-of-the-milfoil," he adds.

A question of bugs

Every summer for the past seven years, Norma Caroon has gone to battle with the milfoil that has piled up along the shore in front of her house. Pushed there by strong easterly winds, the milfoil has been held in place by the bulkheads lining her sound-front property. Within days the thick plants would begin to decompose and fill the air with a putrid stench.

Like her neighbor, L. C. Barrow, Mrs. Caroon was getting tired of fighting milfoil. "We haven't enjoyed the water sports as much as we used to," she said. But there were more serious problems that bothered her. Could the thick, rotting mats of milfoil provide a breeding ground for disease-carrying insects?

According to North Carolina State University entomologist Richard Axtell reports of increased biting fly activity around the milfoil made sense. Studies along the Gulf Coast had already proven that accumulations of shoreline vegetation were good breeding spots for Stomoxys or stable flies. He and extension specialist Charles Apperson suspected that a similar problem might exist with biting fly development in milfoil along Currituck Sound. With Sea Grant funds the researchers set out to see if it did.

Special traps were used to sample both adult and emerging larval insects. Floating mats of milfoil were checked regularly for insect activity. Fresh milfoil was collected and stacked at test plots to see what effect milfoil at different stages of decomposition had on insect breeding.

After nearly six months of monitoring the scientists failed to find significant levels of insect breeding in the milfoil. Axtell admits that he was surprised by the results. But he adds, "We definitely feel the



Emergence trap used in milfoil study

potential is there for the vegetation to be a breeding area under the right weather conditions."

During the study period strong waves and high tides frequently inundated shoreline accumulations of the milfoil. Axtell suspects that many of the larval insects developing in the milfoil may have been drowned or washed into the sound. As a result, the researchers believe that the suitability of milfoil as a breeding habitat and producer of biting flies varies from year to year according to weather conditions.

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Off the presses

Here's an update on recent UNC Sea Grant publications. Residents of North Carolina may receive single copies free of charge. Prices for non-residents are listed in parentheses. Please include the publication number(s) with your request. Checks made payable to UNC Sea Grant should accompany orders. Write: UNC Sea Grant, Box 5001, Raleigh, N.C. 27650.

A look at Sea Grant in North Carolina 1977

A report on the activities of UNC Sea Grant in 1977. by Mary Day Mordecai

(no charge)

An annotated bibliography on mechanically separated finfish and crustacea meats

by Freda Ramey UNC-SG-77-17 (\$0,75)

Access to the nation's beaches: legal and planning perspectives

An examination of the issues facing public access to beaches.

by David Brower UNC-SG-77-18 (\$3.00)

A feeding tray for use in eel farming

Details on the design and construction of an eel feeding tray.

by William Rickards, John Foster, Walter Jones UNC-SG-78-04 (no charge)

Bringing the catch home

A guide to preserving and preparing fresh fish caught or purchased on the coast.

UNC-SG-78-05 (no charge)

Nesting habits and breeding populations of the least tern in North Carolina

by Leon Jernigan, Robert Soots, James Parnell, Thomas Quay UNC-SG-78-07 (\$1.75)

Minced fish: it's production and use

Introduction to the technology of minced fish and product applications. by Tyre Lanier, Frank Thomas UNC-SG-78-08 (\$1.50)

North Carolina marine education manual

Multi-disciplinary curriculum guide on marine topics for grades four through nine. UNC-SG-78-14A Unit I—Coastal Geology (\$1.50) UNC-SG-78-14B Unit II—Saltwater (\$1.50) UNC-SG-78-14C Unit III—Coastal Ecology (in press) UNC-SG-78-14D Unit IV—Appendices (\$1.00)

Oops...

In the May issue of the Sea Grant College Newsletter it was incorrectly reported that the United States Coast Guard was considering buying back outmoded LORAN-A systems that couldn't be converted to the new LORAN-C system of navigation. The recommendation was just one of several made to the Coast Guard. It was immediately rejected by the Coast Guard as being too expensive and difficult to administer.



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UNIVERSITY OF NORTH CAROLINA

SEA GRANT COLLEGE NEWSLETTER

January, 1979

105 1911 Building NCSU, Raleigh, N.C. 27650 Tel: (91<u>9) 737-2454</u>

Sea Grant '79

Come summertime, the populations of three major North Carolina beach resort areas increase a whopping 142 percent. Increases such as these along our shores bring dollars into the local economy—travelers spent an estimated \$168 million in the coastal counties in 1977. But those travelers also bring problems. The very beaches, sounds and marshes that attract them must be protected from the effects of increased development, such as sewage overloads.

Though the quantity of fish being caught in North Carolina waters has increased in recent years—in 1977, seafoods brought \$28.4 million at the dock—so have food needs. In the United States, the need for more food taxes stocks of popular fish while less well-known species are not sought out. On top of that, fish are affected by man-induced changes in the environment.

North Carolina's coast has much to offer and the demands on it are many. But its use must be tempered with an understanding of the fragile environment. To assist in the wise development of coastal resources, the University of North Carolina Sea Grant College Program this year is supporting 20 coastal research projects, four marine education programs, and



13 advisory agents and specialists.

Researchers this year are investigating the possibilities for new seafood products, improved sewage disposal, seafood safety and packaging, fish management, the impact of off-road vehicles on sand dunes, coastal storm hazard areas and much, much more.

Advisory personnel are working with the charter boat industry, recreational and commercial fishermen, seafood processors and coastal landowners.

A \$1.4 million grant from federal and state government supports the program. Researchers are located at the University of North Carolina at Wilmington (UNC-W), East Carolina University (ECU) in Greenville, North Carolina State University (NCSU) in Raleigh and the University of North Carolina at Chapel Hill (UNC-CH). Advisory agents are located in the state's three coastal Marine Resources Centers, in Morehead City and in Raleigh.

What follows is a brief description of our program for 1979. For more information, contact the individuals named or the Sea Grant office in Raleigh (see Sea Hunt?, page 8).



Food from the sea

North Carolina's seafood industry has come a long way in recent years. In 1977 it was a \$161 million business. But, as any fisherman can tell you, there's still room for improvement. Six Sea Grant-supported food from the sea projects are lending a hand this year.

Right now new markets hold the promise of expansion for the industry. Recent studies show that consumers in inland areas would buy large quantities of fresh and frozen seafoods if they could get consistently good products. But because seafoods are highly perishable, transportation over long distances has been a problem. This year food scientists Tyre Lanier, Frank Thomas and economist Ed Leonard of NCSU are working on methods to determine the quality of fish and predict its shelf life. They will then develop packaging designed to protect the fish during shipment, prolong shelf life, and improve attractiveness to the consumer.

About 15 million pounds of croaker were caught off North Carolina in 1977. Though croaker is an excellent source of protein, most of the catch was ground into pet food and fertilizer. Food scientists Don Hamann, Frank Thomas and Tyre Lanier of NCSU think the protein could be put to better use. For the past two years, they've been working on products that are appealing to the consumer. So far they have developed a luncheon loaf, a wiener product, fish jerky, spreads and dips. This year they are trying to identify and eliminate the handling and processing practices that lead to poor texture of

croaker meat.

Before any of the new products can be commercially produced and marketed, there's one important question that must be answered: how long can the fresh or frozen products be stored safely? Hamann and his associates would prefer to produce products without using artificial preservatives. In that case, shelf life depends largely upon the types of bacteria present and how fast they reproduce. This year NCSU food scientists Marvin Speck and Bibek Ray will be doing bacteriological studies on the new products.

Speck and Ray also have received funding for another project which could have important repercussions in the seafood industry. They are trying to develop a test to differentiate between pathogenic and non-pathogenic bacteria in seafoods. There's evidence that the standard tests being used to determine the safety of shellfish aren't entirely reliable. The scientists are looking at two types of bacteria which have been known to cause outbreaks of food poisoning: Vibrio parahaemolyticus and Vibrio cholera.

Aquaculture is one way of making better use of the ocean's resources. For the past five years Sea Grant has funded an experimental eel farm near New Bern. Researchers have raised American eels which are acceptable to connoisseurs in Japan, where the eel is considered a delicacy. This year the operation is moving to bigger and better facilities at ECU's Coastal Resources Center near Aurora. Sea Grant's associate

director Bill Rickards and technicians John Foster and Jack McCauley are continuing experiments with nutrition and pond production dynamics. The farm is a demonstration project and is open to the public. For an appointment or more information, call 737-2454 in Raleigh.

NCSU fisheries biologists Howard Kerby and Mel Huish plan to run another type of aquaculture experiment at Aurora this year. They will crossbreed striped bass with white bass and white perch. It's a known fact that certain hybrids can improve fish stocks, but so far no one has experimented on a large scale with these particular hybrids. If successful, their work could be the beginning of a new type of commercial aquaculture.

Sometimes tradition is a casualty in the march of progress. Harker's Island, for instance, is one of North Carolina's oldest traditional fishing and boat building communities. But increased tourism in recent years has begun to radically affect this little island. Anthropologist Marcus Hepburn has been living on the island for the past year, studying the social organization, labor attitudes and general way of life of the islanders. Anthropologists Jim Sabella and Richard Dixon and political scientist Roger Lowery of UNC-W hope that a better understanding of this community will help open channels of communication between the islanders and the management agencies which affect them.

Coastal studies

North Carolina's coast is a changing, dynamic place. While the dunes, beaches and sounds have the look of permanence, they are always changing. Sand grains shift and accumulate in one place one year and in another the next. Inlets open, close, or simply wander. The constant battering of winds and waves shapes the coast. Sea level is rising and in some areas land is subsiding. The mainland gradually is being gobbled up while the barrier islands move westward.

In the midst of all that impermanence, man has pitched his tent and imposed his boundaries. Homes and businesses continue to spread across the coast. Tourists flock in. Fishermen continue to ply the waters. The demands on the coast are many. While man and science can't tame nature, there are ways to live in greater harmony with the dynamic coastal environment. To help learn how, Sea Grant is funding five research projects in coastal studies this year.

Vegetation plays a crucial role in stabilizing the coast. Where grasses grow, sand is trapped and accumulates. This year, Sea Grant-supported researchers are taking a look at two areas where the grasses are important.

In recent years, NCSU botanists have established that marsh grasses can in some cases be used to slow and even reverse estuarine shoreline erosion. This year Ernie Seneca, Steve Broome and oceanographer Ernie Knowles are continuing their efforts to determine just where and under what conditions the grasses can take hold and work. The information will

be provided to homeowners, county agents and Sea Grant advisory agents.

Just as the marsh grasses play a crucial role in estuarine stabilization, other grasses protect beach sand dunes. Where those grasses are destroyed, dunes—and nearby development— are more susceptible to the destructive forces of nature. In preliminary studies last year, biologists at UNC-W learned that steady traffic from off-road vehicles (ORVs) on the dunes depletes grass supplies. Paul Hosier and Tom Eaton found that in one study area the ORVs kept the sand so churned up that only half as many grass species were present. They also found that the grassy area behind dunes usually was destroyed.

This year Hosier and Eaton are continuing their studies of ORV impacts on the beach-dune environment. In addition to the grasses, they are studying beach profile changes, overwash, sand transport and intertidal organisms. The information will be provided to federal, state and local officials charged with management of the more than 300 miles of beach in North Carolina.

Grasses of course provide little protection from the severe storms which strike our coast. For example a



Off-road vehicles leave their mark

100-year storm, such as Hurricane Hazel, has the capacity to flood coastal North Carolina up to an elevation of about 11 feet, according to coastal engineer Jerry Machemehl of NCSU. Machemehl is continuing work this year to map the coastal areas susceptible to flooding and wind damage from storms of varying intensities. In addition, Machemehl will spell out safe construction features for the coastal area. This information, along with maps delineating the hazard areas, will be published for the public this year.

Currents and waves affect everything from erosion to offshore dumping of sewage. In recent years researchers have concentrated on the currents and waves well off North Carolina's shore. There is, however, much to be learned about the nearshore area of the ocean. Two groups of researchers are beginning work this year to better define and predict what's happening with waves and currents in the nearshore ocean—from the surf up to 20 kilometers offshore.

At NCSU oceanographers Ernie Knowles and Bob Weisberg are analyzing data on waves to predict nearshore ocean conditions in response to such factors as storms. That information should be of use to fishermen as well as coastal engineers.

But in order to assess the mass movements of water in the nearshore area, new instruments must be developed. Oceanographer Tom Curtin and engineer Yates Sorrell of NCSU this year are attempting to develop an inexpensive device to measure more accurately nearshore currents. Experiments will be carried out off Nags Head to test the instrumentation. Once the devices are developed, it will be possible to calculate the transport and mixing of any pollutant discharged into or entering a region. The device will be useful to communities considering ocean outfall of treated sewage.



Carolina Beach a month after Hurricane Hazel

Estuarine studies

Estuaries, by definition, are mixing zones, where ocean water meets fresh water. But they also are among the most biologically productive areas on the coast. They provide nursery grounds for countless species of fish and shellfish, sinks for runoff from the mainland and buffers against the torrents of coastal storms. In North Carolina there are more than two million acres of estuarine water, making the state's coast one of the most unique in the nation.

Unfortunately like many important natural systems, estuaries also are very vulnerable to the effects of pollution. Last year nearly a fourth of the state's shellfishing waters were closed due to pollution, much of it a result of man's activities. Translated into dollars and cents, such closures can mean tremendous economic loss.

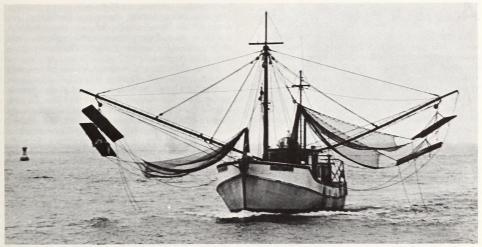
This year Sea Grant is funding eight research projects dealing with the state's estuarine resources. Taken together, these projects will help provide a clearer understanding of the estuarine environment and how it can be protected from unwise use.

Results of a Sea Grant study started several years ago by soil scientist Bobby Carlile of NCSU are already helping. Two alternative septic waste disposal systems designed by Carlile have made safe development possible in coastal areas such as Hyde County where nearly 90 percent of the soils are unsuitable for conventional septic systems. This year Carlile is continuing his work with the new systems. He's looking at ways to rejuvenate failing conventional systems and plans to devise a formula for predicting how well different soil types can handle disposal loads.

The effects of pollution aren't limited to water quality. Pollution affects the quality and safety of shellfish as well. In earlier studies microbiologist Mark Sobsey of UNC-CH found that bacterial standards used in testing shellfish quality weren't adequate for detecting viral contamination. Now he wants to find out what sort of relationship exists between sewage contamination and virus levels in shellfish and surrounding waters and sediments. Ultimately that information may make it possible for health authorities to establish shellfish standards based on enteric virus levels. Sobsey also will be testing methods for removing viruses and bacteria in shellfish taken from polluted waters by transferring or "relaying" them to clean waters.

Like Sobsey, microbiologists, Barney Kane and Donald Jeffreys of ECU have found that bacterial standards are not always the best measure of shellfish quality. In the case of the brackish water Rangia clam, they found that the clam has a naturally high level of harmless bacteria. In the past the high bacterial content has kept the clam from being marketed.

Now the researchers think the clam is safe enough to market from a bacteriological standpoint but they worry about problems with taste. Though harmless, the bacteria in the clam give it a "musty" flavor.



Shrimp boats bring in the state's most valuable seafood crop

Kane and Jeffreys are hoping to find ways to reduce the bacterial content of the Rangia and improve its taste, shelf life and overall marketability.

Scientists already know that estuaries are important as nursery grounds. It's there that many larval and juvenile forms of fish grow and develop into adults before returning to the sea. But how do seasonal and environmental variations affect the role of the estuary as a nursery? Biologist John Miller of NCSU hopes to begin answering at least part of that question. This year Miller is looking at the seasonal abundance of croaker, spot and related fish in the Pamlico River estuary and how their distribution relates to such environmental factors as depth and vegetation.

In some cases weather can be the critical factor in fish survival. Last year a deadly combination of a cold winter and wet spring nearly decimated North Carolina's shrimp fishery. Total catches were down by nearly two-thirds from previous years.

Despite the disastrous season, shrimp continues to be the state's most valuable seafood crop. And as the stakes get higher, so do the fishing pressures. But deciding how to manage this valuable resource isn't easy. For example, premature opening of the fishing seasons can spell disaster. Biostatistician George Fishman of UNC-CH believes that it is possible to predict both the biologic and economic effects of various shrimp management policies. Fishman is developing a prediction model that will help resource agencies in North Carolina and elsewhere make better management decisions. The model will take into account the biology and behavior of shrimp as well as the geographic, social and economic character of the North Carolina fishery.

There are 23 species of colonial waterbirds that nest in North Carolina. For most people these birds are simply fun to watch and photograph. But for

biologists they have a very special meaning. Their population reflects the overall health of the environment because they frequently are at the top of food chains. For several years Jim Parnell of UNC-W and Bob Soots of Campbell College have been studying North Carolina's waterbirds.

They've found that under the proper conditions, man-made dredge spoil islands can provide ideal nesting habitat for birds. And as more and more natural areas are destroyed, these man-made sites become more important. This year Parnell and Soots are evaluating various techniques for creating and improving nesting habitat. Eventually they hope to develop a model for the management of colonial waterbirds in North Carolina estuaries.

Pamlico Sound is virtually synonymous with North Carolina's estuaries. But despite it's importance, relatively little is known about the sound, its circulation patterns or its responses to atmospheric conditions. This year oceanographers Bob Weisberg, Len Pietrafesa and Jerry Janowitz of NCSU are continuing physical studies of Pamlico Sound started last year. Information collected in their study will be used for predicting storm surge, flooding and erosion patterns along the sound as well as the movement of sediments and contaminants.

Recreational fishing is one of the most popular pastimes along North Carolina's coast. Ironically little is known about the fishery, who is involved in it, how it affects local economies or even its impact on commercially important fish species. This year sociologist Peter Fricke of ECU is examining some of these questions. Through a series of surveys and interviews he hopes to find out such things as the social characteristics of the recreational fisherman and how much money is spent on an average fishing trip. What he finds out will be valuable to coastal resource management agencies.

Advisory services

It's the job of Sea Grant's network of advisory agents and specialists to see that the results of research are made available to those who need them the most. Whether there's a landowner struggling with shoreline erosion or a seafood processor plagued by sanitation problems, it's up to the advisory agent to field the questions and come up with the answers.

Of course answers don't always exist. Then it's also up to the agent to suggest areas where more research

is needed.

Sea Grant advisory agents and specialists work in marine fisheries, recreation, seafood processing, coastal engineering and marine education. Some agents are located at the North Carolina Marine Resources Centers on Roanoke Island, Bogue Banks and Fort Fisher. Others are at the NCSU Seafood Lab in Morehead City, the Sea Grant eel farm near Aurora, and on the NCSU campus in the Sea Grant office.

For more information on the activities of Sea Grant's advisory services, contact the individuals

listed below.

Though 20 of the state's 100 counties front the ocean or sounds and thousands of North Carolinians flock to the beaches, little emphasis has been placed on marine education until recently. In response to growing interest across the state, specialist Lundie Mauldin (NCSU, 737-2454) is now working with public school teachers, the University system and the North Carolina Marine Resources Centers to encourage the development of marine education statewide. One of her projects is the publication and distribution of a series of North Carolina marine education manuals.

All too often nature's whims take coastal property owners by surprise. Erosion lops off chunks of estuarine backvards, bulkheads crumble, beach houses suffer from the ravages of harsh weather. To give folks a hand, coastal engineering specialist Spencer Rogers (N.C. Marine Resources Center/Ft. Fisher. 458-5780) is working with individual homeowners on coastal construction and erosion problems. In addition, this year he is working with the Coastal Resources Commission on rules and regulations

governing coastal construction.

A growing part of the North Carolina coastal economy is tied up in one way or another with recreation-from boating to surfing, fishing and hang gliding. Often both the recreation businesses and the sportsmen could use some help. That's where economist and recreation specialist Leon Abbas (NCSU, 737-2454) comes in. This year Abbas plans a series of workshops for marina operators and charter boat owners. He'll also work closely with the sports fishing bait industry. And, moving inland, he'll sponsor a series of lectures on coastal recreation in populous sections of the state.

Four agents are located at the N.C. Marine Resources Centers. Though they have areas of



Sailing in the Neuse River near Oriental

specialization, they're all there to serve the coastal public in whatever way they can. Dennis Regan (N.C. Marine Resources Center/Roanoke Island, 473-3937) is located in one of the recreation hot-spots of the state. His specialities are marina operations, charter boats and tourism. In 1979 he plans to present a series of programs on recreational safety and coastal ecology. Regan also is continuing work with Dare County residents to establish an Outer Banks bike trail.

Hughes Tillett (N.C. Marine Resources Center/Roanoke Island 473-3937) is an old timer with Sea Grant. A native of Wanchese and a former commercial fisherman, he's a well known source of reliable information on fishing off the Outer Banks. This year Tillett is continuing to introduce local fishermen to new hydraulic and electric gear for small boats. And he'll work with folks interested in starting clam and oyster culture operations in all sections of the coast.

Skipper Crow (Marine Resources Center/Bogue Banks, 726-0125) is involved in the problems that concern fishermen too. But he also has a special interest in seeing that North Carolina seafood reaches new markets as far inland as the Midwest. This year he's continuing work started last year on the feasibility of marketing North Carolina skates and rays in Europe.

While he too works with commercial fishermen, Jim Bahen (N.C. Marine Resources Center/Ft. Fisher, 458-5498) also spends a good deal of time with sports fishermen. This year he plans bait rigging workshops and a film series on blue water fishing. For more commercial interests, Bahen is holding LORAN-C workshops, continuing work on gear development, such as new nets, and he's also experimenting with clam and oyster aquaculture.

From hosting workshops on fish preservation and developing new products to redesigning processing plants to improve energy conservation and lower production costs, the Seafood Lab is an important source of information on just about anything that involves seafood. This year the staff at the lab will be working more extensively with smoked fish and preparing a handbook on marine contaminants in seafood. The staff includes: Dave Hill, Joyce Taylor, Sam Thomas (NCSU Seafood Lab, Morehead City, 726-7341) and Frank Thomas (NCSU Food Science Department, 737-2956).

Education

Part of the job of making better use of coastal resources involves people and helping them to understand the marine environment. In the last few years, Sea Grant's education program has grown by leaps and bounds. This year, four major education projects are being supported in addition to a full-time marine education specialist (see Advisory services, previous page).

At NCSU, an option in marine education is being added to the graduate program in the Department of Mathematics and Science Education to meet the growing need for specialists in the field. Graduates of the program will be qualified to teach in community



colleges and technical institutes, serve as educational consultants or supervisors and/or demonstration teachers in elementary and secondary schools. The curriculum is being developed by science educators

Norm Anderson and Ron Simpson.

Law students at UNC-CH are continuing this year to research legal problems concerning state and national needs in the management of ocean and coastal resources. The research began in conjunction with a Sea Grant-sponsored course, Ocean and Coastal Law, which now has been incorporated in the law school's curriculum. This year students are examining the state's permit letting program under the Coastal Area Management Act, federal/state consistency determinations in the coastal area of North Carolina, and legal constraints in aquaculture development. The students are supervised by UNC-CH law professor Tom Schoenbaum.

This year for the first time, Sea Grant is offering fellowships to both graduate and undergraduate students. Three graduate students will be supported in the University's marine science doctoral program. And five minority undergraduates will be given internships at campuses offering marine sciences. The program is administered through the Sea Grant of-

fice at NCSU. For details, call 737-2454.

Finally, a continuing education program for fishermen will provide on-the-spot training at technical schools, community colleges and the North Carolina Marine Resources Centers. Courses will be offered in business affairs, power systems, nets, marine electronics, navigation and marine refrigeration. Jim McGee of ECU's Division of Continuing Education is getting the program underway this year.

Sea Hunt? See What? Sea Grant?

In coastal and Great Lakes states Sea Grant folks are working for the wise use and protection of coastal and marine resources. Information on coastal questions and developments is shared in a nationwide network of 27 programs.

Sea Grant was created by Congress in 1966 along the lines of the tried and true land grant college concept. Federal funding is administered through the Department of Commerce, and, in North Carolina, funds are matched with money from the state Department of Administration through its Office of Marine Affairs. Funding is granted on an annual basis following proposal submission and review.

In North Carolina, Sea Grant got started in 1970. What began as a modest attempt at research has matured into a broad program of coastal research, advisory services and educational programs.

The North Carolina Sea Grant office is on the NCSU campus. The staff includes program director, B. J. Copeland, associate director Bill Rickards, secretaries Frances Holland, Lynda Blair and Elaine Murray. Down the hall, the three folks who bring you this newsletter and other publications hang out. They are Karen Jurgensen, Mary Day Mordecai and Jinny Worthington.

For more information on Sea Grant in North Carolina, write us at Box 5001, Raleigh, 27650. Or, if you like, stop by our office at 105 1911 Building on the NCSU campus. Our telephone number is (919) 737-2454

2454

Gimme ...

The Newsletter

Sea Grant's newsletter is free for the asking. Just fill in the form, drop it into the mail to Sea Grant, Box 5001, Raleigh, N.C., 27650, and we'll put you on our mailing list.

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UNIVERSITY OF NORTH CAROLINA



February, 1979

SEA GRANT COLLEGE NEWSLETTER

APR 28

105 1911 Building NCSU, Raleigh, N.C. 27650 Tel: (919) 737-2454

Looking out for Cape Lookout



An aerial view of Cape Lookout Lighthouse

The Cape Lookout Lighthouse, with its diamondshaped pattern, has stood watch over treacherous waters near Core Banks since 1859. But if nature is allowed to follow its natural course, the days of this well-known landmark are numbered.

The culprit is Barden Inlet. It was during a 1933 hurricane that this inlet cut through the junction of Core and Shackleford Banks. Ever since, it has been gradually eating away at the sandy shore in front of the lighthouse.

In 1975 the erosion rate at the lighthouse site began to accelerate greatly, reaching an alarming rate of 23.4 feet per month in 1977. At that rate, the lighthouse would be in the water by May of 1981. Since 1940, however, the overall rate of erosion has been 2.8 feet per month. Using that rate, scientists figure that the lighthouse could last until 1993. As of December, 1978, the lighthouse stood 310 feet from the inlet and the lighthouse keeper's quarters, only 125 feet.

Proposals to develop the Cape Lookout National Seashore Park brought official discussion of the lighthouse's plight to a peak last year. The issue is complicated by the fact that there are a lot of fingers in the lighthouse pie. The lighthouse itself, 200 feet of property surrounding it and a nearby cement block oil house are owned by the U.S. Coast Guard. The lighthouse is still used as a navigation aid.

The rest of the structures in the lighthouse complex—a keeper's house, a summer kitchen, a generator house and a coal and wood shed—all belong to the National Park Service. The Park Service also has acquired most of the privately owned property on Core Banks in preparation for the development of the national seashore. The U.S. Army Corps of Engineers is responsible for dredging the Barden Inlet channels.

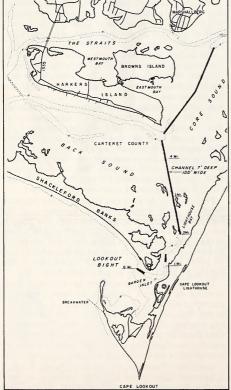
Lastly, the State Division of Archives and History is involved because the lighthouse complex is listed on the National Register of Historic Places. That agency is authorized to see that proper measures are taken to preserve the lighthouse and attendant buildings.

All these agencies are now working together to find answers to two basic questions: Should the lighthouse be saved? If so, what's the best way to do it? Plans now being considered run the gamut from moving the lighthouse to moving the inlet channel. Preston Riddel, Superintendent of the Cape Lookout National Seashore, predicts that a decision will be made by early spring.

Local opinions

Naturally, the perilous position of the lighthouse has not gone unnoticed by residents of the area. Harkers Islanders and fishermen who use the inlet have been speculating about it for years. And some of them have strong opinions.

Take Paul Hodges, for instance. From his Harkers Island marina, Calico Jacks, he has a good view of the lighthouse. Like many of his fellow islanders, he would hate to see the historic landmark disappear into the inlet. The lighthouse, he contends, is too



Dots outline channels in Barden Inlet. Dark areas indicate channels which are dredged by the Corps of Engineers.

much a part of the history of that section of the Outer Banks. It speaks of an era when the Outer Banks were the rugged domain of seasoned sailors and commercial fishermen. To say nothing of the fact that the lighthouse has become a prime tourist attraction.

Like many of his friends, Hodges has some ideas about what's causing the erosion at the cape. "I don't have a degree in engineering, but I've got a teeny weeny bit of common sense," he says. "You can take all the engineers and all the pencils and paper you want, but you can't convince me that the Corps isn't partly to blame for that erosion."

Hodges is referring to the fact that, since 1938, the Corps of Engineers has periodically done maintenance dredging of channels in the 2200-foot wide inlet. For the past 15 years, the Corps has used a sidecaster dredge to move about 34,000 cubic yards of sediment annually in the inlet. Dredging is usually done once a year and takes between one and three weeks.

Over the years, severe shoaling has caused the channel to migrate closer to the Core Banks side of the inlet. Hodges believes that the Corps' continued dredging of Core Banks can have only one effect; in-

creased erosion near the lighthouse.

Hodges is expressing a commonly held opinion that the Corps should move the channel closer to the Shackleford Banks side of the inlet. That's reasoning that falls flat with Lim Vallianos, chief coastal engineer with the Wilmington office of the Corps of Engineers, Vallianos recently completed a study of the erosion problem at the cape. He points out that the Corps does not dredge in the section of channel directly in front of the lighthouse. That, he says, is a naturally deep channel, which needs no maintenance dredging. What's more, Vallianos says, to dredge across the shallow section of the inlet near Shackleford Banks would be complicated and practically futile. The natural ebb and flow of the inlet would quickly fill in the dredged channel, he contends.

To dredge or not to dredge

Hodges is not suggesting that the Corps cease dredging in Barden Inlet. For one thing, that would have a drastic effect on his marina business. The inlet is heavily used by both commercial and sport fishermen going to Core Banks or to the open ocean. It easily accommodates boats with a draft of five feet or less. And it's a favorite of small boaters because it's one of the calmest inlets on North Carolina's coast.

"I've seen days when the whole Morehead City fleet of charter boats would have to use Barden Inlet because Beaufort Inlet was too rough to get into,"

says Hodges.

Vallianos points out that inlet migration is a natural phenomenon. In fact, he contends that Barden Inlet has one of the lowest movement rates of all North Carolina's inlets. He points to New Inlet, which has moved a total of 7,000 feet in one direction, in spite of the fact that it has never been dredged. He adds that movement rates in some inlets actually drop after dredging is begun.



Satellite photo shows chennels and shoaling in Barden Inlet. Body of land on right is Core Banks, on left. Shackleford Banks.

But there are some experts who side with the popular opinion held by Hodges. Dr. Robert Dolan, a coastal geologist who has studied the Cape Lookout erosion problem, agrees that it is a difficult issue to handle. "One can debate the devil out of that forever," he says.

Dolan believes that when man interferes with inlets, things start happening in an unpredictable way. "These tidal inlets are so complex and the balance between erosion and deposition in the channel is so delicate that anything that is done from an engineering standpoint contributes to the erosion," he says.

Dolan points to the case of Oregon Inlet, which he believes has been radically affected by the construction of the Oregon Inlet Bridge.

But Dolan and Vallianos agree on one point: with the water almost lapping at the lighthouse, it's too late to bicker over who's responsible for the eroding shoreline. Any plan for saving the lighthouse must be undertaken immediately.

Nitty gritty

If things go on schedule, the question of what will become of the Cape Lookout Lighthouse will be decided by late spring. Work on the project could begin by early fall. And, if present erosion rates continue, that might be just in the nick of time.

The National Park Service, which operates the Cape Lookout National Seashore, began to take a serious look at the Core Banks erosion problem in late 1976. That year, the agency commissioned Dr. Robert Dolan, a coastal geologist at the University of Virginia, to study the problem. During 1978 the Park Service funded two other studies—one to examine the feasibility of moving the lighthouse and another erosion study by Dolan. In October, 1978, the U.S. Army Corps of Engineers completed an in-depth study of the erosion problem at the cape. The U.S. Coast Guard also has drawn up suggestions for management of the lighthouse. These agencies have held several joint meetings to discuss the problem.

The issue was officially opened to public debate in mid-January this year with meetings held on Bogue Banks and in Raleigh. Representatives of the Park Service, the Coast Guard, the Corps of Engineers and the N. C. Division of Archives and History presented their recommendations for action.

Prior to the meetings, a summary of official proposals for management of the lighthouse was mailed to about 300 people on the Park Service mailing list. The Park Service will receive public comment through February 17. Letters should be addressed to Superintendent, Cape Lookout National Seashore, P.O. Box 690, Beaufort, N.C. 28516. Proposal summaries are available upon request.

After considering public comment, the group of concerned agencies will jointly decide which plan to use. One of the agencies—either the Park Service or Coast Guard—will then request emergency funding from its Congressional budgetary committee.

At the moment, seven official proposals are being considered. Agency officials seem to be agreed on one point: there is no time to waste. Consequently, they are skeptical of any plan which might require an environmental impact statement. That process could hold up the work for years.

What follows is a summary of the proposals put forward by the Corps, the Coast Guard and the Park Service.

The Corps of Engineers research project was headed by chief coastal engineer at the Wilmington office, Lim Vallianos. The Corps sees four possibilities:

Plan 1A, Bank Revetment The first and preferred alternative calls for a revetment 2350 feet long to be constructed of granitic stone riprap on the shore in front of the lighthouse. The initial cost of this embankment would be about \$3.3 million. Additional annual costs, including interest, maintenance and surveys, would total \$225,000. Construction time is estimated to be 110 days.

Plan 1B, Extended Revetment This plan calls for the revetment to extend to a length of 3800 feet. The extension would be designed to prevent severe erosion at the edges of the revetment. Initial costs would be about \$5.5 million and annual costs would total \$414,000. Construction time would be about 170 days. Vallianos favors construction of the shorter revetment outlined in Plan 1A.

Plan 2, Training Dikes A series of training dikes would be constructed, extending perpendicularly from the shore in front of the lighthouse. The dike system would be designed to induce flows away from the eroding bank. According to Vallianos, this would be the most visually obtrusive of the Corps' proposals. Initial costs would be about \$3.5 million and annual costs would total \$274,000. Construction time is estimated at 160 days.

Vallianos notes that similar systems constructed in river beds have required bank revetments because eddy currents which set up in between the dikes may continue to erode the shore. In that case costs of the project would be considerably higher. Vallianos adds that this plan would have a greater chance of success if a physical model were constructed. But that would take a year. There is also the possibility that the dikes might present a navigation hazard at night, he adds.

Plan 3, Relocation of the channel A new channel would be dredged to the west of the main channel. The old one would be filled in and sand would be pumped onto the shore in front of the lighthouse. This would take about 195 days. The relocated channel, like the present one, would naturally migrate toward Core Banks, Vallianos contends. That means that the entire dredging operation would need to be repeated every 10 years. The cost of moving the channel would be \$2.9 million; annual costs would be about \$428,000.

Vallianos believes that because of the design risks, this plan is least likely to be successful. It will also probably require an environmental impact statement, and environmental constrictions ten years from now might prevent relocating the channel. The plan's only advantage, Vallianos believes, is that it would not change the appearance of the cape area.

Vallianos estimates that five to seven months would be required to make plans and award a contract for any of the Corps' proposals. Some protection would be afforded to the lighthouse during construction of either Plan 1 or 2. But Plan 3 would afford little erosion control until completion.

Moving the lighthouse Last fall the Park Service commissioned MTMA, a Raleigh consulting firm, to investigate the possibility of moving the lighthouse, the keeper's quarters, the summer kitchen and the storage shed. The lighthouse is 169 feet tall, with walls eight feet thick at its base tapering to two feet thick at the top. MTMA determined that the lighthouse could be moved if masonry saws were used to cut it into seven parts, each weighing less than 300 tons. "It would be sort of like cutting a frankfurter

up," says firm member Chris McLure. The cost would be about \$2.1 million.

The Coast Guard has proposed three alternatives: Replacement of the lighthouse If the decision is made to abandon the lighthouse, the Coast Guard would replace it with a navigation tower. A 150-foot steel tower would be built near the Cape Lookout Coast Guard Station. The cost would be about \$525,000.

Protective barriers To save the present structure, the Coast Guard proposes to construct either of two types of protective barrier around the lighthouse to prevent erosion. A steel sheet pile bulkhead with a tieback system would cost \$1.6 million. A stone rip rap would cost \$2.6 million. Both systems would be designed to withstand a scour of up to 20 feet below mean low water.

The decision makers are likely to be influenced by Dr. Larry Tise, the state historic preservation officer. Because the lighthouse and surrounding buildings are listed in the National Register of Historic Places, Tise is responsible for seeing that they are preserved.

Tise does not endorse the Coast Guard proposal to protect the lighthouse but abandon the surrounding buildings. He also is skeptical of the proposal to move the lighthouse and buildings because that would destroy the historic setting and the possibility of archaeological excavations in the future.



Park superintendent Preston Riddel in front of keeper's quarters and lighthouse.

Guarding the 'paradise'

As early as 1590 explorer John White labeled Cape Lookout "promontorium tremendum"—horrible headland. Sailors quickly grew to fear its deadly combination of safe harbor and treacherous shoals.

In spite of the danger, it wasn't until 1812 that the lighthouse was built. The original lighthouse, surrounded by a grove of trees, did not resemble its contemporary version. A tower of brick was built inside a wooden frame building painted in horizontal red and white stripes.

This early lighthouse got mixed reviews from mariners using the Cape Lookout area. Some complained that early morning fog often obscured the light. Consequently, in 1852 the old lantern light was replaced with a more efficient system. At the same time, construction was begun on a taller tower which was completed in 1852.

The new 169-foot red brick tower became the prototype for all the lighthouses subsequently built on the Outer Banks. It wasn't until 1873 that this lighthouse was painted in its distinctive diamond pattern.

Building anything on the desolate stretches of Outer Banks was complicated, as all materials had to be hauled by barge from the mainland. For the lighthouse job a special dock and railroad track were constructed. A team of horses pulled a flatbed carrying supplies from the dock to the site. According to amateur historian Sallie Moore of Morehead City, one of the stories that has been passed down through the generations on the Outer Banks is that the brickwork was done by a single Irish brickmason. The story goes that the center stairway was built as the brick was laid so that no outside scaffolding was needed.

The brick tower and the light were damaged by Confederate troops before they surrendered the Outer Banks to Federal troops in 1862. In 1863 the original wooden stairway was recognized as a fire hazard and replaced by a cast iron spiral stairway.

The keeper's quarters that now stand between the lighthouse and the inlet were built in 1873. A second six-room frame house was constructed in 1907. This building has since been moved to private property on Core Banks. No one knows the exact construction dates of the other buildings now standing on the lighthouse property—a generator house or summer kitchen, a coal and wood shed and a small cement block oil house. But all of the buildings are believed to have been completed by 1905.



Wild ponies on Shackleford Banks. Herds of similar wild ponies used to roam Core Banks.

Today personnel from the Coast Guard station on Core Banks visit the lighthouse periodically to see that the automatic equipment is functioning properly. But until 1950 a keeper, and often two assistants, were required to operate the lighthouse. They were hired by the Lighthouse Bureau, which was taken over by the Coast Guard in 1939.

The job of the keepers was to make sure that the light was functioning properly at all times and to maintain the property. Lighthouse keepers also remained in close contact with the men who manned the nearby lifesaving station about a mile down the beach. It was a peaceful, isolated life, with home and work nearby.

Willard Willis' father was an assistant keeper at the lighthouse during the 1930s and early 1940s. Today Willis' barber shop in Beaufort is plastered with photographs of Cape Lookout. He likes to reminisce about idyllic summers on the island.

"When I was a child, Core Banks was just as clean and beautiful as it could be. There were cattle, horses and sheep that kept it just like it had been mowed every day. It was just a paradise, is what it was," he says.

Off the presses

Here's an update on recent UNC Sea Grant publications. Please include the publication numbers with your request. Checks made payable to UNC Sea Grant should accompany orders. Write: UNC Sea Grant, Box 5001, Raleigh, N.C. 27650.

Wreck Diving in North Carolina

A directory of shipwrecks along the North Carolina coast.

By Dennis C. Regan and Virginia Worthington UNC-SG-78-13 No charge.

Storms, People and Property in Coastal North Carolina

Historical and meteorological data on North Carolina's major coastal storms. Includes tips on survival and safety.

By Simon Baker UNC-SG-78-15 No charge.

Estuarine Shoreline Erosion in North Carolina

A series of five colorful posters depicting erosion in four of the state's major estuaries: Core/Bogue Sounds, Albemarle Sound, Pamlico River and Neuse River. Each poster includes a map with a description of shoreline types and erosion rates. The fifth poster ("Cause and Effect") explains the reasons for estuarine erosion.

By Stan Riggs, Mike O'Connor, Vince Bellis No charge. Please specify which posters you want.

Seafood Sourcebook

A consumer's guide to information on food from our oceans and lakes. Bibliography. Published by the New England Marine Advisory

Service, Sea Grant Program.

Available from UNC Sea Grant. No charge.

Home Smoking and Pickling of Fish

A consumer's guide.

Published by the University of Wisconsin Sea Grant Program, with a special insert on smoking North Carolina style.

Available from UNC Sea Grant. No charge.

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